TRANSACTIONS

OF THE

CUMBERLAND ASSOCIATION

FOR THE

ADVANCEMENT OF LITERATURE AND SCIENCE.

PART I.—1875-6.

EDITED BY J. CLIFTON WARD, ASSOC. R.S.M., F.G.S.

SINGLE MEMBER'S COPY, PRICE ONE SHILLING. FURTHER COPIES TO MEMBERS AND COPIES TO NON-MEMBERS, PRICE TWO SHILLINGS AND SIXPENCE.

KESWICK:

PRINTED BY R. BAILEY, COCKERMOUTH AND KESWICK.

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BRITISH MUSEUM NATURAL HISTORY

KESWICK:

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EDITOR'S PREFACE.

THE first Part of the Association Transactions is necessarily imperfect in many ways. It was, however, thought advisable to commence the work of publication with the close of the first year of the Association's existence, although the material to hand, bearing the stamp of originality, was somewhat limited. It is hoped that each year will witness an increase in the number of Papers dealing with subjects of original investigation or local interest.

NOTE.—The Paper by Mr. SNELUS, at the end of this Part, came too late for its title to be included in the list at the commencement.

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"Old Borrowdale." by J. F. Crosthwaite, (Keswick).

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RULES ADOPTED AT A MEETING TO ESTABLISH THE CUMBERLAND ASSOCIATION FOR THE ADVANCEMENT OF LITERATURE AND SCIENCE,

FEBRUARY 28th, 1876.

1. That an Association be formed to be called the "CUMBERLAND ASSOCIATION FOR THE ADVANCEMENT OF LITERATURE AND SCIENCE."

2. The Association shall consist of all members of the following Societies, Whitehaven Scientific Association, Keswick Literary and Scientific Society, Cockermouth Literary and Scientific Society, Workington Scientific and Literary Association, and of the members of such other Societies as shall be duly affiliated. Also of persons not belonging to any of the affiliated Societies, if nominated by two members of the Council; this latter class of members shall pay the sum of 5s. annually.

3. The Association shall be governed by a Council, consisting of a President, Vice-Presidents, Secretary, Treasurer, and of ordinary members, two to be elected by each affiliated Society.

4. The President, Secretary, and Treasurer, shall be elected annually at the Annual Meeting, and be capable of re-election.

5. The Vice-Presidents shall consist of the Presidents of the various affiliated Societies; and the delegates of the various Societies shall be elected annually by their respective Societies.

6. An Annual Meeting of the Association shall be held at such time and place as may be decided upon at the previous Annual Meeting, or (failing such appointment) as may be arranged by the Council.

7. At each Annual Meeting, after the delivery of the President's Address, and the reading of the Reports from the affiliated Societies, the objects of the Association may be furthered by Lectures, Papers, Addresses, Discussions, Conversaziones, &c. The Council shall have the power of obtaining the assistance of persons who are not members of the Association.

8. The Council may publish at the expense of the Association such

portions of its own or of any of the associated Societies' communications as may be deemed advisable, subject to the consent of the author.

9. The Council shall endeavour to promote co-operation among existing Societies, and may assist in the formation of new ones; it may also aid in the establishment of classes in connection with any of the associated Societies.

10. Affiliated Societies shall contribute towards the general funds of the Association the sum of Sixpence for each member.

11. The Rules can only be altered by a majority of two-thirds of the members present at an Annual Meeting, Any member desiring to alter the rules must send a copy of the proposed alterations to the Secretary, at least two weeks before the meeting is held.

OFFICERS FOR THE SESSION 1876—7.

:o:

PRESIDENT.

THE LORD BISHOP OF CARLISLE.

VICE-PRESIDENTS.

JAMES BAIRD, ESQ., (Whitehaven.)
J. CLIFTON WARD, ESQ., F.G.S. (Keswick.)
ISAAC FLETCHER, ESQ., M.P., F.R.S. (Cockermouth)
H. F. CURWEN, ESQ., (Workington.)

COUNCIL.

T. F. I'ANSON, ESQ., M.D.
WILLIAM JACKSON, ESQ. } Whitehaven.

ALEXANDER A. H. KNIGHT, ESQ., M.D.
J. F. CROSTHWAITE, ESQ. } Keswick.

REV. W. WILLIAMS, F.G.S.
HENRY DODGSON, ESQ., M.D. } Cockermouth.

GEORGE J. SNELUS, ESQ.
A. PEILE, ESQ. } Workington.

TREASURER & SECRETARY.

J. CLIFTON WARD, ESQ., F.G.S.

PROCEEDINGS AT THE ANNUAL MEETING.

The following Programme was carried out:—

MAY 1st.—1-0 p.m.—Luncheon.

2-30 p.m.—Address by the President, the Lord Bishop of Carlisle.

3-30 p.m.—Excursions—

(a). Docks, Shipyard, and Lonsdale Iron Works.

(b). Geological Excursion along St. Bees Cliff.

(c). Colliery Excursion (Henry Pit).

8-0 p.m.—Conversazione in the Town Hall, including the following addresses and papers:—

Demonstrations on Spectrum Analysis by Mr. G. J. Snelus, and on the Radiation of Heat by Mr. J. Baird.

Plumbago Coining-Moulds found in Wastdale, by Mr. R. S. Ferguson.

"Tokens" of Cumberland and Westmoreland, by Mr. Wm. Jackson.

MAY 2nd.—10-0 a.m.—GENERAL MEETING in the Lecture Hall, Howgill-street. Election of Officers and next year's place of Meeting. Discussion as to the work of the various Societies.

11-0 a.m.—Reading of Original Papers:—

THE CUMBERLAND DIALECT, by Mr. John Richardson.

HARBOURS AND DOCKS, by Mr. J. E. Williams.

SKETCH OF THE GEOLOGICAL HISTORY OF THE LAKE DISTRICT, by Mr. J. Clifton Ward.

INAUGURAL ADDRESS OF THE PRESIDENT, THE LORD BISHOP OF CARLISLE.

In looking forward to the delivery of an address such as that which is demanded from me to-day, the question must always arise, "Shall I write it or, shall I speak it?" A good deal may be said (as is usual in the case of problems admitting of two solutions) in favour of either course. I will not trouble you with the arguments which have chiefly weighed with me in the present instance, but merely say that upon due consideration I have come to the conclusion that I should perform my duty best, as the President of this infant Association, in making the speech which inaugurates its birth, if I set down beforehand on paper what I intended to say. One advantage at least will accrue from this determination, namely, that I shall not be tempted by the interest of the subject to address you at an unreasonable length—a temptation which you will scarcely regard as imaginary, when I tell you that your Secretary, in a communication which he, perhaps, regarded as "privileged," used these remarkable words with reference to our meeting of to-day: "Please do not hesitate to give us 'a good strring up,' of about an hour's duration." I do not exactly know what will constitute, in the opinion of your worthy Secretary, "a good stirring up;" but I confess that the notion of performing that irritating process for the duration of a whole hour somewhat appals me, and I trust that you will find me more merciful. Nevertheless the subject before us is, in truth, one of vast extent, and which it will require some care to reduce to reasonable dimensions, and, at the same time, to treat profitably, or with anything like completeness.

THE GOOD EFFECT OF FORMING A CONFEDERATION.

The Association which we inaugurate to-day, and to which you have given the bold title of "The Cumberland Association for the Advancement of Literature and Science," appears to be a confederation of a number of existing societies, with the proposal to affiliate other similar societies if formed, and with the offer of membership on certain terms to suitable persons, not members of any affiliated society, either existing or to exist hereafter. Assuming the fact of a number of separate societies,

it is not difficult to understand that considerable advantage may arise from some kind of confederation being established among them. The possibility of advantage is so obvious, that I observe very little is said of the *raison d'être* of the Association in your printed rules. It is obvious, I think, that if the purposes and operations of the component societies be good, their confederation will also be good. Such confederation will naturally lead to mutual encouragement and to progressive improvement. Each society, without sacrificing its independance, will have the advantage of seeing and knowing what is done in others. There will be, as it were, a comparing of notes, and any bright thought originated by some vigorous secretary will have free course beyond his own society. Moreover, I should trust that the effect of confederation would be to excite emulation in those places in which no affiliated society exists. It seems remarkable (if I may say thus much by way of illustration) that we should inaugurate an Association for Cumberland from which the name of Carlisle should be conspicuously absent. One may hope, ever bearing in mind the assumption that a literary and scientific society is a thing good in itself, that the Association will find before long an affiliated society in each of our larger towns ; and then it may be added, upon the general principle that *l'union c'est la force*, that, without attempting to define too carefully the further operations of an Association like this, there will doubtless be a variety of ways in which a confederation will be able to give an impetus to the cause for which it has been formed, such as would have been quite impossible for any local society, however vigorous and however well managed.

THE PURPOSES FOR WHICH THE INDIVIDUAL SOCIETIES EXIST.

Passing, then, from the general question of the advantage of confederation, I will trouble you with a few words concerning the purposes for which as I understand them, the individual societies exist. Of the four societies which at present constitute our "United States," one is called "Scientific" only, and the other three "Literary and Scientific," or, to be more exact, two of the three are "Literary and Scientific," and the third "Scientific and Literary." I shall not be far wrong if I assume that the purposes of all four societies are much the same, and that I may

regard them all as both literary and scientific bodies. It may, of course, be a question in what manner a society, in a not very large town in Cumberland, is able or will attempt to cultivate or promote literature and science. Taking the phrase in its broadest and fullest meaning, I suppose that the effects of such a society must be of a very modest kind. Nevertheless, it is well to examine what can be done; and I shall venture to submit a few thoughts to you, for which, of course, no one is answerable but myself, and which, therefore, you may take for what they are worth, and for no more.

1. Turning first to Literature, I presume that a literary society in a country town will probably have the usual literary machinery of a library, reading-room, and so forth. These things will have a variety of advantages, direct and indirect, which it is unnecessary for me to discuss. Like all similar appeals to the higher intellectual portion of human nature, they will tend to encourage worthy tastes, they will give educational facilities to those who would otherwise not be able to pay for them, and they will be more or less advantageous, according to the more or less of wisdom with which they are managed. But I think they may be made to do something more than this; and I will mention two ways in which, not to mention others, good work may be done. The first is this. A literary society affords a ground upon which the few highly cultivated intellects of a neighbourhood can be brought into profitable contact with the many less highly cultivated. Be it ever remembered that there are comparatively few intellects of the first quality sent into this world, and that not all of these are cultivated as they might be. But you generally find in any neighbourhood a certain number (it may be only two or three) of minds capable of imparting valuable thoughts to others; and the possessors of those minds are frequently not churlish or selfish, and would be most willing to impart of their abundance if they only knew how. The opportunity of coming in contact with such men, and hearing them speak, observing how they deal with a subject, following the workings of their minds—all this, independently of any actual information conveyed, is a delight and privilege; and a literary society makes this kind of meeting of minds not only possible, but easy. I think with melancholy

pleasure upon days gone by when I say this: to have met years ago in the lecture-room of the Cambridge Philosophical Society, such men as the late Professor Sedgwick, to mention only one name, is a thing for which to be thankful to the last day of one's life. The other way in which a literary society may be advantageous, and which it has occurred to me to mention, is this. There is much of what I may call local literature, which may be studied with advantage through the instrumentality of local societies. No country is richer than Cumberland in local customs, and peculiarities, and history. These things like the ruins of the Roman wall, or our old castles and abbeys, are in a continual condition of decay; folk lore constantly becomes more difficult to collect; local traditions and curious local superstitions have a tendancy to vanish; even our fine Cumberland dialect is likely to be improved off the face of the earth by schoolmasters and school-boards; and a local literary society may do good work by being to such like things that which a local museum is to antiquities—namely, a home where they may find rest in the midst of the bustle and progress of this prosaic, matter-of-fact world. I observe that one of the arrangements for to-morrow is a paper on "The Cumberland Dialect," by Mr. John Richardson. I can easily conceive that the transactions of a very humble literary society might, with the help of an intelligent secretary (for that is quite indispensable), become, in the course of say fifty years, of great and general value.

2. And, now, turning to Science, much of what I have said concerning literature will, *mutatis mutandis*, be applicable. But the field of operation for a local society, with respect to science, is, if I am not mistaken, more extended than it is with respect to literature. The pursuit of literature is chiefly confined to the house, and to the time that can be given to books, but science may be cultivated, in a certain sense, everywhere, and at all times (*semper, ubique, et ab omnibus*), and it is perfectly possible that a local scientific society, with the indispensible requisite (to which I have before referred) of a good secretary, and therefore, with good direction and management, may teach men, who are not professionally scientific, to make many useful observations, and to add much to their own enjoyment of this world in which God has placed them.

I wish to speak temperately upon this point, because I know enough of exact science, and of the labour which exact science requires, to make me fully appreciate the modest limits within which any scientific efforts of an amateur must of necessity be confined. Nevertheless, most men may be taught habits of observation; they may be instructed what to observe, and how to observe it; and I should imagine that (to take the lowest view) the man who has cultivated habits of observation will prove in almost all the practical employments of life more handy and more useful than the man who has not cultivated such habits. Men differ very much in their natural endowments as regards this matter. Some men, like myself, are unfortunately short-sighted, and are almost incapable of observing anything; and some men are incapable of caring about the things to be observed. I remember hearing two men discussing the geological formation of a country through which they had both travelled, when a third, interposing, sagaciously asked, "If the *roads* be good, what possible difference *can* it make what there is lying underneath them?" But the large majority of mankind are observing animals, and though the science of observation and classification be not very high in the scale, it is, for the majority of men, the most accessible, and it is the basis of much that is very useful. Let me add that if one country be more favourable than another for calling out the power of observation, few can be better for the purpose than this county of Cumberland. Moreover, a good deal of useful practical work may be done in the way of excursions. I perceive from your programme that it is intended to do something of the kind this afternoon. And with reference to this question I should like to record the pleasure which I once enjoyed in being permitted to spend a day in an excursion with the members of a society, more or less resembling those with which we are concerned to-day. The plan was this: we met at a certain railway cutting, where a geological member explained to us the section of strata which the railway operations had brought to light, and gave us a short lecture on the geology of the neighbourhood. Then we visited some local antiquities, which were explained by an antiquarian, who told us something of the history of the

district in ancient times. We next fell in with a church, where an ecclesiologist gave a lecture on architecture; and soon after, a botanist happily stumbled upon a rare plant, which he forthwith pulled to pieces and expounded for the benefit of those who were botanically inclined. "A little learning" is, proverbially, "a dangerous thing," but "a little learning" acquired under such circumstances as I have described, is certainly very agreeable, and, notwithstanding the proverb, I would trust not very dangerous.

But there is another thing which a local society may do for science, and upon which I would lay great stress as being really important, and as a work which cannot be done in any way so well as through this kind of agency. I refer to the establishment of a local museum. I do not hesitate to say that in my opinion every town, worthy of the name (I mean every town as distinguished from a mere village), ought to have its museum. You will, I hope, understand what I intend to express by the term "museum." I do not mean a mere cabinet of miscellaneous curiosities, than which few things can be more useless; but I mean an orderly, well-arranged, collection of things, interesting on the score of science, or antiquity, or beauty, which the neighbourhood supplies. The degree of perfection which such a museum can attain will depend, of course, upon a variety of circumstances; but, if only a local scientific society will start a museum, and lay down the fundamental law that trash is to be excluded, the collection will quite certainly become sooner or later valuable. And there is one department beyond others for which, if I am not mistaken, a museum is specially required—it is that of antiquities. In almost all neighbourhoods, and, I should conceive to a pre-eminent extent in Cumberland, antiquities come to light from time to time; men plough up, or dig up the monuments of past days—records, it may be, of Roman occupation, or of our British ancestry, or of Border warfare, and the treasures so found go sometimes one knows not where. Now, it is in the highest degree desirable that they should not be lost, and that they should not pass into private collections; and the way to secure this is to establish a local museum. and to let it be known (which is very easy) that all treasure-trove brought there will find a ready pur-

chaser. I speak of a local museum as being of special importance with regard to antiquities, because these, of course, are limited in number; and when once a relic has been found, and lost or destroyed, it is gone for ever, and nothing can take its place. But a museum is of not much less importance with regard to local specimens, illustrating the geology, or the fauna or flora of the district. This might well be undertaken under the auspices of our affiliated societies, and it might be matter of honourable rivalry amongst them which should possess in the various departments the most complete or most valuable collections. Other remarks might be made touching the beneficial operation of local literary and scientific societies; but those which I have offered to you are perhaps as plain and obvious as any, and I trust as useful and important. They are certainly as numerous as my time on an occasion such as this would seem fairly to allow. I pass on, therefore, from the more immediate consideration of the advantages and the operations of such societies to make a few general observations concerning literature and science, which seem to be germane to the present occasion, and which I should be sorry to omit.

GENERAL RÉMARKS ON LITERATURE AND SCIENCE.

For the question naturally occurs to myself, and will probably occur to others who take an interest in the proceedings of this day, and, it may be also, to some who take no such interest, "Why should the Bishop of the Diocese be invited, and why should he consent to be the first president of an association for the advancement of literature and science?" Certainly it cannot be on the ground of anything which he can himself personally do in the advancement of literature. For, alas! a bishop in these days is a man of letters chiefly in the sense of being a man who has a fearful amount of letters both to receive and to write; and as for science, a scientific bishop is still more impossible and inconceivable than a literary. I myself, though I have received that kind of education which is necessary for the study of the higher departments of science, and though I know very well the delicious taste of the fruit of mathematical research, have long long ago been compelled to forego all such delights, and to regard the progress of science at a respectful and ever increasing distance. Still I cannot but feel that there is a certain propriety, I will not say in your

proposing, but in my accepting this office, based upon the strong ties which bind together literature and science with those purposes to which I have more especially been led by God's providence to devote my life and my labour. At all events, if I had declined the office, when you had done me the honour to propose it to me, it would have seemed as if I had by that act, declared that in my judgment there was no necessary or intimate connection between the work of a Christian bishop and the work which the name of your association implies. Now, my opinion is exactly the reverse of this. I believe that the work of a Christian bishop, and that of men who combine themselves for the purpose of advancing literature and science, are very closely allied—much more closely than is often supposed. Anyhow, I am quite sure that your road and mine lie to such an extent in the same direction that we may very well be on friendly terms, and try to help each other. For look to the question of literature, and observe to what a great extent the religion which Christian people profess is what I may call without offence, a literary religion. Those to whom the first propagation of the faith was entrusted committed their knowledge to writing. They did not merely move the hearts of people by sermons and speeches, but they wrote books; and so it became possible from the beginning, and it became essential in after times, to appeal to the Holy Scriptures—that is, to literature. *Litera scripta manet;* and, under God, the Church was founded upon a rock just because it had a written basis upon which to rest. And so, to take as an example one of the most stirring periods of Christian history, and that in which we are chiefly interested as members of a reformed Church—I mean the great Reformation movement of the sixteenth century—it should be observed that this was distinctly a literary movement. The men who made the stir were contemptuously called "men of the new learning." It was the study of Greek, and the general movement in the direction of candid literary investigation, and independent criticism, and literary discovery, which made the great religious revolution of the sixteenth century both a possibility and a necessity. I do not wish to travel far into this subject, the more so as it is possible that I may be speaking to some who would not agree with me in regarding the ecclesi-

astical revolution of the sixteenth century as a reformation; but the literary character of the movement cannot be doubted, neither can the importance of literature in the conduct of the controversy which has raged more or less ever since. But apart from this question of the Reformation it may be averred that the deeper and more general question of the defence of the truths upon which the Christian Church stands has tended more and more, as time goes on, to connect itself with literary considerations. I have already remarked upon the manner in which, according to the good providence of God, the revelation of His will was made from the beginning to depend upon books; but as time went on those books became antiquities; the original copies were lost or worn out; the books had to survive the perilous period of manuscript transmission, previous to the more secure and calm days of printing; and so they have become subject to all the questions of genuineness, and authenticity, and balance of probability for this reading and that, to which all ancient books are subject; so that independently of the almost infinite amount of devotional, historical, homiletical, and other literature connected with Holy Scripture, there is a large amount devoted to the scientific establishment of the sacred text, and the discussion of the genuineness and authenticity of each component book, which can only be sound and good when it forms a part of a literature which is based upon sound scientific principles, and has the benefit of the labours of the most clear-headed and most skilful literary labourers whom the age afford. Thus, I think, you will perceive that it is impossible to any one who takes an interest in the Christian faith to be indifferent to literature, and especially to what I may call literary science; and this leads me to the further remark, that if an association for the advancement of literature be one in which a person occupied and pledged as I myself am, may rightly take an interest and a part, this is equally true—perhaps even more true—in the case of an association for the advancement of science. Under the term "science" I should, of course, include all departments —the lowest as well as the highest. I have already said that I think there are branches in which you and your various local societies may do good service, but I shall not be so foolish as to flatter you by saying, or

as to imagine that you yourself believe, that in the higher or highe branches you can make any great advances; nevertheless I may with propriety speak quite generally of the advancement of science; and I think it very desirable to assert that there can be nothing in that advancement, whether in the modest manner which you probably propose to yourselves, or in the broader way which is open to the British Association, whose descriptive name you have not been to modest to adapt and adopt, which does not demand the sympathy of all Christians, whether bishops, or priests, or laymen. Of course I do not expect that every man is to know much of exact science; nor, indeed, do I expect to think it necessary that every man should take a keen interest in scientific results. I had once a friend, who was a most distinguished literary man—a great writer, a great reader, a man of most prodigious memory, most cultivated taste, and most varied acquirements—who nevertheless assured me that he viewed all scientific questions with absolute and complete indifference. He never could understand the least particle of mathematics; and he cared not a bit whether the earth revolved round the sun, or the sun round the earth, or whether neither of them revolved at all. It is a curious question for examination, how far experience warrants us in saying that the literary and scientific tastes usually accompany each other. I am disposed to think that the two do much more usually accompany each other than not. You may find literary men without any taste for science, such as he to whom I have referred; and, on the other hand, dry men of science, like him who was said to have read Shakespeare through, and then to have asked what it all proved? But my belief is that these are the exceptions not the rule; the monsters, not the normal typical animals. Take a few examples of the combination of high literary taste and scientific power, such as the following: Aristotle, Bacon, Pascal, Leibniz, Sir John Herschel, and Whewell, to which list many more might be added. I was speaking of my scientific friend. Such men may be curiosities, but they are facts; and bearing in mind that facts are stubborn things, I do not feel justified in claiming that every one should even take an interest in scientific matters; but I think we may certainly say this: that in the present epoch of the world's history it is well that science should be as

accessible as possible, and that men should be accustomed to distinguish between science real and sound and science falsely so called. Societies such as yours will do something if they only give currency to sound views on scientific subjects—if they only lead men into healthy lines of thought; if they only help men to perceive that science, if it be science indeed, must be, and cannot fail to be, a form of the knowledge of God.

But, to take what may be regarded as a somewhat lower and yet very important view of this subject, I think it may fairly be argued that societies which mark upon their banner "literature and science" do so far declare themselves as intended and intending to minister to the better and more spiritual side of men's nature, that they may be rightly regarded as allies of that other society in which I am more directly appointed to bear office. This age in which we live is undoubtedly a very utilitarian age. I do not assert—and I do not in reality believe—that it is worse either in this respect or in many others than some of the ages which have gone before; but certainly there is much in the atmosphere of our times to make us look very earnestly to the utilitarian side of almost every subject, for unquestionably this our age is one of unprecedented command of money, and command of mechanical power, and consequent command of luxury. It can scarcely be called a simple age; and though there has been a large and very happy development of taste in many departments, still, upon the whole, there is also a very great tendency towards the worship of the material, and a temptation, in the way of literature, to magnify the *Times* newspaper as greater than Thucydides, and in the way of science to lay special stress upon such things as iron shipbuilding, and steam hammers, and electric telegraphs. This being so, there is something comforting in the mere fact of the juxtaposition of the terms literature and science in such a manner as to make it clear that both the one and the other are intended to be taken in a higher sense—that literature is intended to embrace all the wisdom of the past which has been embalmed and conserved in good books; and that science is intended to witness all kinds of knowledge which the human mind is able to acquire by observation, or study, or discourse of reason, whether the same can properly be regarded as technically useful or not. Thus it may be said

of literature and science, and therefore of societies which are based upon them, that they tend to correct some of the special defects of our age and country; and I will go further than the consideration of utilitarianism, and the evils directly or indirectly connected with it, and I will say that even with regard to religious questions I look for help and not for hindrance from well conducted literary and scientific societies. It would be most improper and undesirable that I should make this address the occasion of overstepping the bounds which good sense and good taste dictate, and of dragging you, along with your president, into the hot atmosphere of religious controversy; but I think I may say without offence, and without fear of contradiction, that such an atmosphere does exist, and that it is very unpleasant, and that some good people find it hard to breathe it. In the proximity, then, of such an atmosphere, I can scarcely do wrong in eulogizing the influence of literature and science as valuably prophylactic, and as having a tonic and embracing tendency. The more carefully and deeply men read, and the more they think, and the more they really know, the more tolerant will they be of views different from their own, and the more disposed will they be to live in charity with those who differ from them. And if the literary and scientific society in a country town be little more than the common ground upon which we can meet and exchange thoughts, and, at the same time, learn something of what is being done in the world of literature and science, and be led to appreciate to some extent there own ignorance, it may not have discharged its highest functions, but it certainly will have produced a result not altogether to be despised. Nay, I would venture to say that even in softening down political asperities—in causing Yellows and Blues to coalesce upon many subjects in a common colour—and generally in producing neighbourly feeling and goodfellowship in the best sense of the term, a literary and scientific society may do a work—humble it may be, but not to be disregarded, not to be altogether put aside. So long as it is true that "Blessed are the peacemakers," and so long as the differences of opinion, and contrariety of interests, and the miscellaneous jostling of one against another in this busy world tend to give rise to feelings opposed to peace and good-will, so long may a society which brings men together

on common ground, upon which it is difficult to pick a quarrel, be regarded as a social advantage, and as an institution upon which all good men may look with favour and with hope.

But I must stop. The subject is tempting, and one feels to be warming to the work; but the "stirring up" has already approached more nearly to an hour's duration than I had intended when I commenced my address, and I will bring it, perhaps somewhat abruptly, to a close, by thanking you for the honour you have done me in electing me as your first president, and by adding a sincere expression of my most earnest hope that your Association may grow and prosper, that you may have many presidents more efficient than myself, and may be able to do all the good that you desire, and much more than you are bold enough to expect.

REPORTS FROM THE ASSOCIATED SOCIETIES.

WHITEHAVEN SCIENTIFIC ASSOCIATION.

HOWGILL STREET.

SESSION, 1875—1876.

President. ... ... H. A. FLETCHER, F.R.A.S.

Vice-President. ... ... JAMES BAIRD.

Past Presidents.

T. F. I'ANSON, M.D. | WILLIAM JACKSON.
AUGUSTUS HELDER. | W. H. KITCHIN.

Committee.

E. ABLETT, M.D. | R. F. MARTIN.
JOSEPH ADAIR. | J. W. MONTGOMERY, F.C.S.
ARCHIBALD KITCHIN, F.C.S. | R. PICKERING, C. E.
R. RUSSELL, C.E.,F.G.S.

Curators.

Botanical } ... ... { JOSEPH ADAIR.
Zoological } ... . { E. ABLETT, M.D.
Geological ... } ... ... { R. PICKERING, C.E.
Mineralogical } ... ... { R. RUSSELL, C.E., F.G.S.
Archæological ... ... { T. F. I'ANSON, M.D.
{ W. JACKSON.

Treasurer .. .. JOHN S. HELLON.

Hon. Secretary ... ... B. TAYLOR.

MEETINGS were held during the Session as follows:—

Oct. 19.—Conversazione—Introductory Address by the PRESIDENT.

Nov. 2.—J. D. KENDALL, M.E., F.G.S.—On Valleys and Valley-Gravels, their bearing on the question of the Antiquity of Man.

Nov. 16.—T. THOMPSON—On Cumberland Past and Present.

Dec. 7.—EDWARD CROMPTON,—On Railways, their Permanent Way and Signals.

Dec. 21.—C. Mc.GLASHAN,—On Coral Formations.

Jan. 4.—A. KITCHIN, F.C.S.—On some of the Phenomena of Light experimentally illustrated.

Jan. 18.—R. RUSSELL, F.G.S.—On Pompeii.

Feb. 1.—W. JACKSON, J.P.—On Cockermouth Castle.

Feb. 15.—JAMES BAIRD,—On Heat.

Mar. 2.—W. H. KITCHIN,—On some Curiosities of Plant Life.

Mar. 16.—M. PATERSON, C.E. — The Life and Writings of Thomas De Quincey.

Apr. 6. EDWARD ATKINSON, On the Postal Telegraph System.

Apr. 20. Conversazione, Election of Officers &c.

Hour of Meeting 8 *p m.*

MR. H. A. FLETCHER gave the following report of the work of the Whitehaven Society during the past session :—He was very happy to say that, although they had spent about £160 during the year in providing the cases they had seen in the museum downstairs for the reception of the different articles that had been presented to them, they had still a very handsome balance in hand. They had this advantage, that they had no rent to pay. The rooms were altogether their own property, and of this they were rather proud. They had done something, it would be seen, in the way of a museum, and that was one of the things that the Bishop had alluded to in his address on the previous day as being a very necessary and desirable thing for each Association to have. It had been suggested, and he thought they would be able to carry it out, that in addition to the museum they should have a small library of scientific and technical books, and this will be done in the ensuing year. There had been 36 new members elected during the past year, and the total number now on the books was 243. The session was opened as usual by a conversazione. It was very largely attended, and one interesting feature connected with it was that the visitors comprised a great variety of ranks, from a young Viscount, who was heir to an earldom, down to mechanics and colliers. During the session they had held eleven ordinary meetings for the reading of papers. An original paper was read at each of them, and he thought they had had a little more discussion than in former years. The diversity of subjects was somewhat considerable. Although they called themselves the Whitehaven Scientific Association, they considered it within the scope of their Society to admit subjects of a literary character. Of these eleven papers six had been purely scientific, three archæological, and two literary. The session closed with the annual meeting for the election of officers and general

business, and not as usual with a conversazione, because they felt that as the county Association was likely to hold one in a few days afterwards, it would be desirable to omit that part of their usual proceedings. They had formed an astronomical sub-section during the year, which seemed to have done good work. The number of members of the sub-section was seventeen, inclusive of three ladies, and there had been altogether fifteen meetings, with an average attendance of eight members.

KESWICK LITERARY AND SCIENTIFIC SOCIETY.

7th, SESSION 1875-6.

President .. .. J. CLIFTON WARD, ASSOC. R.S.M.,F.G.S.
Vice-President ... ... ALEXANDER A. H. KNIGHT, M.D.
Secretary ... ... E. J. GRAYSON.
Treasurer ... ... R. R. LOWTHIAN.

Committee.

REV. CANON BATTERSBY, M.A.
REV. W. COLVILLE.
REV. A. HOWSON.
JOHN FISHER CROSTHWAITE.
REV. S. STREETEN, B.A.
A. B. WOOD.

MEETINGS were held during the Session as follows:

SUMMER SESSION.

Field Meetings.

(1.) Crummock Water and Scale Hill.
(2.) Borrowdale (joined by the Societies of Whitehaven, Workington, and Cockermouth.)
(3.) Thirlmere.
(4.) Penrith.

At each of these meetings short addresses were given or papers read on Geological and Archæological subjects.

WINTER SESSION.

ORDINARY MEETINGS.

Held in the Keswick Library at 7-30 p.m.

Nov. 1st.—THE PRESIDENT,—"Electro-Chemical Decompositions," (illustrated experimentally.)

Nov. 29th.—Mr. J. Richardson,—"The Cumberland Dialect and the Bards who have written in it."

Jan. 17th.—Captain Jno. Jackson,—"Incidental Reminiscences in a Sea-Faring Life."

Jan. 31st.—Mr. J. F. Crosthwaite,—"Celebrated Lake Visitors."

Feb. 7th.—Mr. P. Harrison,—"Personal Names."

Feb. 14th.—Discussion on "Our Lake District," introduced by Mr. E. J. Grayson.

Feb. 28th.—Rev. S. Streeten, B.A.,—"Books."

Mar. 13th.—Rev. W. Colville,—"History, in relation to Human Progress."

Mar. 30th.—Mr. P. T. Freeman,—"Elementary Music."

LECTURES.

Held in the Keswick Lecture Hall at 8 p.m.

Nov. 8th.—Rev. C. H. Gem, M.A.,—"Life and Writings of Tom Hood."

Nov. 22nd.—R. F. Martin, Esq.,—"The Great Pyramid."

Dec. 6th.—Rev. Canon Battersby, M.A.,—"Sites of Ancient Assyria and Babylon."

Dec. 20th.—E. J. Hebert, Esq., B.A., F.G.S., of Her Majesty's Geological Survey,—"The Planets."

Jan. 24th.—W. H. Kitchin, Esq.,—"Some Curiosities of Plant Life."

Feb. 21st.—Rev. J. D. Harrington, M.A.,—"A Comparative Sketch of Human Languages,"

Mar. 6th.—Rev. J. Christie, M.A.—"A Tour in Italy."

Mr. J. Clifton Ward gave the following report of the work of this Society during the past session:—The number of members is now 170. During the winter session four kinds of meetings had been held—ordinary meetings, nine in number; public lectures, eight in number (one failing, there were only seven delivered); a chemical class, and a geological class.

Mr. Townley had conducted a chemical class on the basis of Roscoe's Chemistry Primer. The little book was gone through experimentally but the attendance averaged only six in number.

I have held a geological class on nine evenings, the average attendance being twenty-five. Two field excursions were made with the class. At the final examination eight candidates presented themselves and the result was very satisfactory.

The local museum has made considerable progress and the present accommodation is found to be all too small.

Retrospect. Looking back on the work of this and previous years it would seem advisable to extend systematic instruction on special subjects. The Ordinary Meetings give scope for original papers on *varied* subjects, and hence it might be well to divide the lecture course into two parts, one part consisting of a short series of lectures on some *one* branch of science, and the other of lectures on some purely literary subject (such as Our Lake Country Poets, or Social Life in England in past centuries, or the History of a certain period). The formation of classes should also be encouraged and a taste for Natural History specially cultivated.

COCKERMOUTH LITERARY AND SCIENTIFIC SOCIETY.

SESSION 1875-6.

President ... ... ISAAC FLETCHER, ESQ., M.P., F.R.S.

Vice-Presidents T. DRANE, ESQ., C.E. REV. W. WILLIAMS, F.G.S. H. DODGSON, ESQ., M. D.

Committee.

MR. JOSEPH BROWN.
REV. ELDRED GREEN.
JOHN ROBERTSON, M. D.
MR. T. M. HARRIS.
MR. HORACE R. WYNDHAM.
MR. WILLIAM YOUDALE.

Secretary ... ... MR. J. SIMPSON.

Treasurer ... .MR. J. H. WATSON.

Lectures delivered in the Court House, Cockermouth, during the session, as follows:

Hour of Meeting 8 *p.m.*

1875.

Thursday, October 21st.—"The Progress and Decline of Civilization, as illustrated by the Greeks and Saracens." By T. DRANE, ESQ., C.E.

Thursday, November 4th.—"Some of the Phenomena of Life, in relation to Matter and Force." By T. F. I'ANSON, ESQ., M.D.

Thursday, November 25th.—"Thomas Hood—Life and Times." By the Rev. C. H. Gem. M.A.

Thursday, December 9th.—"Locomotion." By the President.

1876.

Thursday, January 6th.—"The Pedigree of the English People." By the Rev. Charles Grant.

Thursday, January 20th.—"Pompeii." By R. Russell, Esq., C.E., F.G.S., of Her Majesty's Geological Survey.

Thursday, February 3rd.—"Cockermouth Castle and its early owners." By W. Jackson, Esq., J.P.

Thursday, February 17th.—"A Fortnight in the Orkneys." By Mr. Thomas Farrall.

Thursday, March 2nd.—"Magnetism and Electro-Magnetism, illustrated experimentally." By J. Clifton Ward, Esq., F.G.S., of Her Majesty's Geological Survey.

Thursday, March 16th.—"Scottish Minstrelsey and Humour." By Mr. W. F. Lamonby.

Close of Session, Business, and Election of Officers.

The programme as given above was successfully carried out, the attendance having been generally better than in previous sessions.

Mr. Ward held a Geological class on nine evenings, the attendance averaging twenty-five. Six members presented themselves for examination, the result being very satisfactory.

WORKINGTON SCIENTIFIC AND LITERARY ASSOCIATION.

SESSION 1875—1876.

President ... ... H. F. Curwen, Esq.
Vice-President ... ... G. J. Snelus, Esq.
Treasurer ... ... Mr. A. Peile.
Hon. Secretary ... ... Mr. G. F. Downar.

Committee.

Mr. T. Milburn. | Mr. R. Whitelock.
Dr. Strang, | Mr. W. Griffiths.
Rev. J. J. Thornley, M.A.

Meetings were held during the session as follows:—

Nov. 3rd.—"Cumberland: Past and Present." By T. THOMPSON, Esq.

Dec. 8th.—"The Alphabet," by Rev. J. J. THORNLEY, M.A.

Jan. 5th.—"The Correlation of Physical Forces," by J. MACFARLANE, Esq.

Feb. 9th.—"The Life and Writings of Thomas De Quincey," by R. W. WHITELOCK, Esq.

Mar. 1st.—"The old Volcanoes of Cumberland," by J. CLIFTON WARD, Esq. F.G.S.

Apl. 26th.—"The Spectroscope," by G. J. SNELUS, Esq.

Hour of Meeting 8 *p.m.*

The Secretary furnished the following report:—

The Committee of the Workington Scientific and Literary Association in presenting their second annual report congratulate the members upon the healthy and vigorous condition of the association. During the past year the progress although unostentatious has been as satisfactory as in the year preceeding; the lectures have been fairly attended, and the discussions that have followed them seem to indicate a growing appreciation of scientific and literary pursuits.

The financial position of the Association is very satisfactory, for whereas at the beginning of the year there was a debt of £13 13s. 8d. there is now a balance of £6 11s. 4d. in the hands of the Treasurer. The association at present numbers 60 members.

GENERAL DISCUSSION ON THE WORK OF THE SOCIETIES.

The subject of the advisability of promoting more systematic work in the individual societies was then brought forward, Mr. Ward mentioning what they had proposed to themselves at Keswick for the next winter session.

MR. MARTIN said he unfortunately came in too late to hear the beginning of the meeting, and almost too late to catch what was said about the astronomical section at Whitehaven, in which he was more particularly interested. At the last meeting of the section, some ten days or a fortnight ago, an interesting discussion took place as to the future of

the section, and he was deputed to say a few words that day, if time were given him, upon this subject. It was felt by all present that they had made a start, perhaps not a formal or a first-rate one, but also it was felt very strongly that another year they should attempt some more definite and more organized work than they had attempted this year. Their attendance at the beginning was very good, and showed signs of considerable elasticity, and it was thought if the section had been advertised more widely they might have got a better attendance. At the last meeting an opinion was expressed that many ladies and gentlemen in Whitehaven would be glad to join the section if it were known and understood, and they would like some more definite course of work and lectures than they had had last winter. What was proposed the other day was that they should endeavour if possible before another winter, to get a regularly organized course of lectures upon astronomy as the work of the section at Whitehaven, and the question which he had before brought before them of the Cambridge system of University extension was discussed. They found that if they applied for a lecturer from Cambridge upon astronomy it would cost somewhere between £30 and £35 a year, if they could get some other town in Cumberland to join them, and it was proposed that they should endeavour, before the next autumn, to get a volunteer to give them a regular course of lectures, and also that the introductory lecture should be given by Professor Stewart, of Cambridge, whose name was so well known. He (Mr. Martin) had promised to endeavour to arrange this on their behalf, and he hoped to be able to report that this would be done some time in the autumn. If so, they would hope to have, at any rate, the sympathy of their fellow-workers in other towns in Cumberland, and possibly, at some future time, to have a regular system of lectures organized at Whitehaven, and perhaps at other places, if the matter were taken up by the fellow-societies.

The Secretary, the Rev. Canon Battersby, and Mr. Peile, all concurred with Mr. Martin's observations.

Dr. I'Anson fully endorsed all that had been said as to the work of the different societies being systematized. Looking back to the early days

of their Association, he remembered that they then attempted special classes to carry out systematic instruction, and they were somewhat unfortunate. The rock on which they split was, he believed, that they attempted too much. Had they really confined themselves to one subject, and one only, during one session, they would have had very much better results. On the contrary, they undertook three special classes, and the consequence was very unsatisfactory, and what Mr. Martin spoke of as having been accomplished during the last session would give good earnest of greater results if the work were more systematically pursued.

In reply to Mr. GRAYSON, the CHAIRMAN said he presumed, in the case of a course of lectures being given by a Cambridge lecturer on the subject of Astronomy, to the expense of which two or more Associations would contribute, it would be arranged for a course of lectures in each of the contributing towns.

The SECRETARY then called attention to the fact that the Societies might render considerable service to each other by the exchange of surplus specimens from their museums.

ELECTION OF OFFICERS, &c.

(GENERAL MEETING, MAY 2ND.)

The following motions were passed :—

Proposed by Mr. H. A. Fletcher, and seconded by Dr. I'Anson, that the Bishop of Carlisle be requested to accept the post of President for another year.

Proposed by Mr. W. H. Kitchin, and seconded by Mr. Fisher Crosthwaite, that Mr. J. C. Ward be re-elected to the posts of Secretary and Treasurer.

Proposed by Mr. Russell, and seconded by Mr. Crosthwaite, that the annual meeting be held in Keswick in May next.

EXCURSIONS.

VISIT TO THE DOCKS, SHIPYARD, AND LONSDALE IRONWORKS.

The party who preferred this excursion were met at the docks by Mr. Williams, the resident engineer, who conducted them over the works. The strong gates that are in cousse of erection were examined, and the process of pile-driving was witnessed. At the shipyard, which adjoins the dock, the company were received by Mr. Patterson, the manager. The drawing-office was first visited, and there the models of the vessels that the Company have built or are building were seen. Walking round the yard they examined the machine for planing the edges and butts of plates, the five punching and shearing machines, the angle-iron cutting machines, &c. As time was limited, the party passed on to the steam-hammer, lately erected in the yard. A block was made from scraps, and the process of converting it into what is called "hammered scrap iron" was illustrated. Instead of having to send this description of iron away, it is wrought into keel bars, and stem and stern posts. The ruins of the saw mill that was burnt down last week were next viewed, and the company passed on to the Lonsdale Hematite Ironworks. We may state that the Shipbuilding Company have in course of construction six barques—one of 1,000 tons, for Messrs. Fisher and Sprott; two of 800 tons each, for Messrs. Jackson and Metcalf; one of 800 tons, for Captain Borrowdale; one of 800 tons, for Captain Connell; and one of 200 tons, for Captain Nelson. In addition to these there are contracts on hand for three other vessels—one of 600 tons, for Mr. Raie, Liverpool; one of 650 tons, for Captain Nelson; and one of 800 tons, for Captain Ditchburn.

The Lonsdale Ironworks, over which the party were kindly conducted by Mr. Baird, managing director, stands on an area of about six acres. There are three furnaces in blast, and one is in course of erection. Those in blast are all close-topped, the gas being utilized for heating air, raising steam, &c., thereby effecting a considerable saving as compared with the old system. The furnaces were tapped in rotation, so that there was abundant opportunity of observing the process of "pig" making. The engine-room was the next department. Here are three large engines, on the "grasshopper" principle, by Barclay, of Kilmarnock. There are seven boilers in operation, heated by gas, and two others are well on towards completion—the latter being required for the new furnace (larger than the present ones, but on the same principle) which is being constructed on the south side of the works. The "hoist" for the new

furnace will be made of bricks (which the Company manufacture themselves) instead of the iron framework of which they are usually made. The heating stoves were visited, and it was here explained that the air, after travelling through these, passed into the furnaces at a temperature of about 1,000 degrees. Lead was easily melted in the stoves by the hot air. The depots for the delivery of iron ore, coke, &c., were also noticed in passing. We observed one improvement in the disposing of slag. Opposite each furnace is a bridge spanning the railway, and on the surface of each bridge is an inclined plane. The slag is lifted by means of a steam-crane, and deposited upon bogies on the incline plane, along which they are run, and the contents are tipped on the shore, the descending bogie bringing back the empty one. Hitherto this task of clearing away the slag had to be done by locomotives, but by the system now adopted expense is saved, and the work is performed more expeditiously. The steam for the crane is supplied by gas. The question was asked at the meeting on Tuesday "Were these slag blocks utilized?" and we may state that they are to a considerable extent. The softer portion is comparatively easily affected by the weather, and is capable of being worked up into a mortar, which, mixed with sand or other suitable material, hardens very soon. Other parts of the slag, when crushed, make a very good concrete, which is valuable for a variety of purposes.

GEOLOGICAL EXCURSION.

Under the leadership of Messrs. Russell, Pickering, and Ward, about 70 members made an excursion along the coast, the various geological features between Whitehaven and Barrowmouth being pointed out.

THE VISIT TO HENRY PIT.

Not the least interesting portion of the programme was that devoted to visiting Lord Lonsdale's colliery on the north of the town. Hitherto the colliery has been known as William Pit, but for the last few years another seam—known as the six-quarter—has been opened out. To enable this to be done, the late Mr. T. E. Forster, who had then the charge of the collieries, determined to sink a new shaft, called Henry Pit, after the Christian name of the present Earl. When Mr. Forster was succeeded by the present manager, Mr. Martin, that gentleman continued to carry out the plans of his predecessor, and at present they have so far advanced that Mr. Martin thought a visit to the place would well repay the trouble to those of the Association who take an interest in such matters. Accordingly, on Monday afternoon, shortly after the appointed time, thirty members mustered at the pit top, and the overmen, deputy over-

men, and wastemen having kindly placed their pit clothes at their disposal, it was not long before the whole were turned out in their new rig. And a motley crew they looked! The diversity of uniform was ludicrous in the extreme. As for ourselves we sported a suit of blue duffle, about the proper size and shape, while the head piece consisted of a very dilapidated white billy-cock. The representative of a contemporary got into a pair of what had very much the appearance of a French sailor's pants that had been made for a man twice his own size, a coat that much resembled the pattern of that of Joseph's of old, while the roof was covered by a sou' wester. Some of the men who supplied the clothing sent their blue flannel shirts, and not a few of the new tenants had got into these over their own clothes, while perhaps a pair of checked horse-knee breeches covered the lower extremities. Many a hearty laugh was enjoyed at the expense of a neighbour, as he emerged from the dressing-room, where the metamorphosis was such as, in some instances, to defy recognition by intimate friends. Everything being ready, Mr. Martin arranged to form the company into three detachments, and despatched Mr. Harker, the viewer of the pit, with the first installment. The visitors were sent down two at a time, an official accompanying each cage, in order that the possibility of an accident should be averted. Mr. Harker's gang having been despatched, Mr. Moore, the viewer on the south side, went down with the first of his party, Mr. Martin remaining to the last. On arriving at the pit bottom the route taken was along the north drift, a distance of 600 yards under the sea. The first part of this drift, for a distance of 300 yards, is through stone, and all arched with brick and must have been both a slow and an expensive process. As soon as the coal was pierced the drift was continued in a straight line, as it is intended at some future period to haul the coal by means of an engine plane. Of course, the workings branch off from the main drift, and also from a second one, which is used for the return air, and up to the present time there are some 19 fore heads in the north district. The company of which we were a member (that piloted by Mr. Moore,) walked right to the fore head at the end of the drift and found a good-sized working, with a good roof some seven feet high. This place was making a little gas, as was evinced by the hissing sound caused by it coming in contact with water. One of the party tried it, with his lamp, and the usual indication of a blue flame presented itself. The ventilation was, however, so good that there was no lodgement of gas. Most of the workings were afterwards visited, and Mr. Moore pointed out such places of interest as were worthy of notice. There was one place of particular interest on the north side that he took care his friends should not depart without having a thorough knowledge of, and one which would leave a lasting impression, not only on the mind, but also on the small of the back, and that was a place known by the name of the

Low Steer. He steered his way through this, and, of course, all hands had to follow suit, whether it suited or not. The height of the Low Steer is something under three feet, and the length of it about 200 yards. A lilliputian brigade of the standard height of that mythical army could march through this place with the greatest degree of comfort, bolt upright; but if anyone whose proportions had ventured to elongate themselves to something like six feet, were seduced to pass through they would find that long before half the distance was covered the spinal cord had undergone an operation which was highly objectionable to the proprietor. A welcome rest at the outer end enabled the party to assume something like their original form, and a move was made towards the south side. It was necessary to go by way of the pit bottom to get to the workings on the other side, and here, as upon the north side, they are approached by a stone drift some 300 yards in length, all arch bricked and being of the most costly and substantial character. The seam here is the same as upon the north side, and the few workings that were visited were almost immediately underneath Bransty Hospital. Approaching the south workings there is a self-acting inclined plane, which will save a good deal of labour. The return journey was then made, and the party rode to bank in twos as they had gone down; and if the Association ever missed a treat it was in not being present to witness the members who had ventured "down amongst the coals," as they reappeared in daylight, with their begrimed hands and faces, their ludicrous apparel, and the absolute necessity for at least a couple of shoe blacks each. A plentiful supply of hot and cold water was, however, provided, with plenty of soap and clean towels; and a large staff of officials having for the occasion been converted into waiting-maids, a respectable toilet was performed, and all were soon again presentable to the outer world.

We may state that the six-quarter seam is about 6½ feet in thickness; is 50 fathoms below the main band, which is being worked in William Pit; and the coal is of a superior quality, especially for coking purposes. We are informed that it is the intention of Mr. Martin to erect coal-washing machines for the purpose of making the small coal usable for making coke; and so convinced is the manager of the Lonsdale Hematite Iron Company of the success which will attend the experiment, that they intend to erect several coke ovens for the purpose of manufacturing their own fuel, instead of having to bring it all the way from the Darlington district, as they do at present. The shaft itself is perhaps one of the finest in the north of England. Its depth is 155 fathoms, and it is 12 feet in diameter, and cased several bricks thick from top to bottom. It is now being fitted up with iron slides for a new double-deck cage, capable of carrying four tubs at a time, and which will shortly supersede the present ordinary cage,

which is only capable of carrying one tub, and runs in iron wire guides In order to work the new shaft efficiently, a 36-inch double cylinder engine has been put down, with a 20-feet winding drum; and the head-gear, which is in course of construction, will, when complete, be some 60 feet high. The columns and girders are of iron, and were made by the Whitehaven Shipbuilding Company. They are, however, being put up by the Granary Yard hands, under the supervision of Mr. Hetherington. Hitherto the ventilation of William Pit has been by furnaces, but the ventilation of the Whitehaven collieries on the south side having been so successfully adapted to the French patent known as Guibal's fan, it has been determined to erect one for the ventilation of both Henry Pit and William Pit. On visiting the fan case we found that it was in a forward state, and when complete, the present shaft into William Pit will be converted into an air shaft, and the whole of the coals will be drawn from Henry Pit. At present Henry Pit is being ventilated by a small Guibal fan, some 10 feet in diameter, and will be driven by a 30-inch double cylinder, disconnecting engine. The steam to drive the winding engine and the fan engine will be generated in five large boilers immediately against the face of Bransty quarry, and the flue goes to a chimney which has made its appearance in the field above. Amongst other improvements on the pit top has been the erection of new screens. The whole of the frame work is made of iron, and when complete will be very commodious; and as soon as Henry Pit shaft is ready to draw the whole of the coals a new inclined plane from the pit top to the screens will come into operation. The tubs will run upon an inclined plane, both from and back to the pit top, a steam lift at the screen end raising the tubs a sufficient height to enable them to find their way back to the pit top alone.

PAPERS READ AT THE CONVERSAZIONE.

ON SOME PLUMBAGO COINING-MOULDS FOUND AT NETHER-WASDALE,

By R. S. Ferguson, M.A.

(This Paper is given in abstract, the author having been requested by the Association to communicate it in full to the Cumberland and Westmoreland Antiquarian and Archœological Society.)

When my friend Mr. Jackson invited me to be present here to-night and to give a short address, he further furnished me with the text of my address in the shape of a mould of plumbago, whose halves have cut on their inside the obverses and reverses of some English coins. This mould was found in April, 1865, in a small cairn of stones in a straggling oak coppice a little outside the village of Netherwasdale, and near to the river Irt. It is composed of two blocks of pure Cumberland plumbago, one weighing 5oz. 3dr., and the other weighing 5oz. 7dr.

The fact that these blocks are blocks of pure Cumberland plumbago is a proof of the genuineness of the discovery, for that material is now both rare and expensive, the mines having been closed for many years. The mould, when open, exhibits the dies of the obverses and reverses of five coins. The largest coin is a groat of either Edward IV. or Richard III. The second coin, in point of size, is the half-groat, exactly similar to, but smaller than, the groat. The other three coins are all the same, and are silver pennies of Henry VII.

We now know all that can be known about these moulds. They are the tools of some coiner, who lived in the early part of the reign of Henry VII.

ON LOCAL TOKENS.

By Wm. Jackson, J.P.

(This Paper is given in abstract, the author having been requested to bring the subject before the Cumberland and Westmoreland Antiquarian and Archæological Society.)

Mr. Jackson exhibited two cases of Cumberland Tokens, the larger one containing twenty-seven, and the smaller four, specimens, and after a few preliminary remarks on the subject of Tokens generally, stated that so very numerous were the varieties, and so extensive had been their circulation at one time when the copper currency was not in the settled condition that it is at present, that a correspondent of his, an ardent collector, possessed not less than 15,000 varieties in his cabinet. He then drew attention to the larger case, the specimens in which (though they had passed in a few instances into the general circulation as pence, halfpence, and farthings, according to their various sizes,) were not formally intended to pass as money, but were given out to carters as certificates that the load of coals taken from the pit, had been duly delivered at the shipping port, and therefore the holder was entitled to receive a certain sum, on presenting the same at the office on pay nights. Each shipping colliery had a die of its own struck off, and one of the specimens exhibited dated as far back as the sixteenth century, which indicated the antiquity of the practice.

The smaller case contained a few of the many pecuniary tokens struck by John Wilkinson, the great iron founder, of last century, whose residence at the foot of Castle Head, near Grange, may be seen by the traveller on the Furness line to Carnforth, on the left, after passing the Grange station. Amongst other very interesting facts in connection with this very remarkable man, it was stated that he was the first who made practical use of coke in the smelting of iron; that he built the first iron vessel; that he was primarily concerned in the erection of the first iron bridge, that of

Coalbrookdale ; and that, at his own express desire, he was buried in an iron coffin, under very peculiar circumstances.

Mr. Jackson asserted that, (though it could scarcely be hoped at a period so remote from his birth, being now one hundred and fifty years, it would ever be proved) there was good reason to believe that Wilkinson was born near Clifton, where his parents resided; near and not at, because it was certain that he was born in a market cart, and, that being so, the event most probably occured whilst his mother was returning from Workington Market to Clifton, a market two miles distant from that town.

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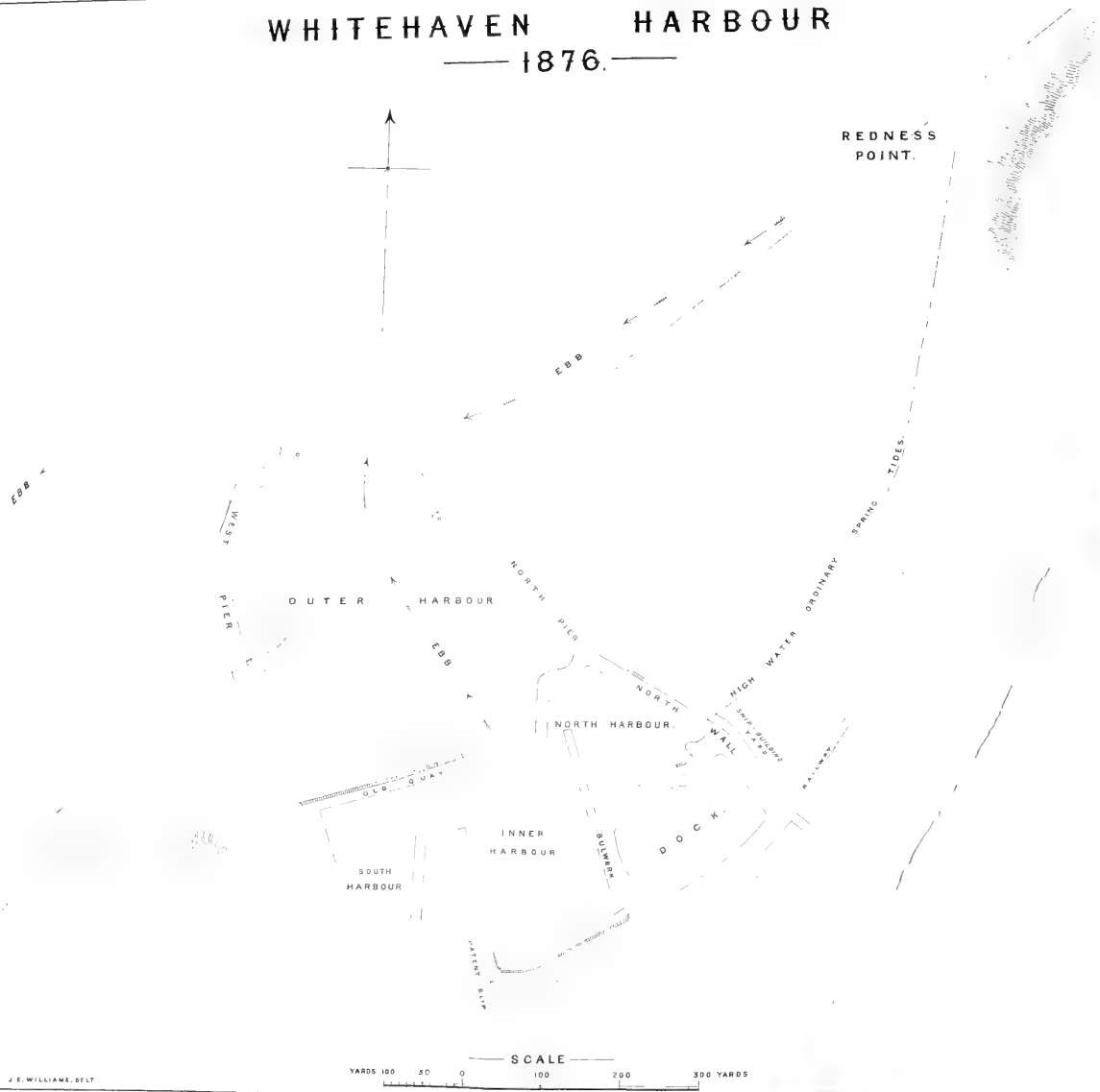
NATURAL HISTORY

WHITEHAVEN HARBOUR

1876.



HARBOURS AND DOCKS.

By J. E. Williams, Resident Engineer, Dock Works, Whitehaven.

(With a Plate.)

It is usual to designate by the term harbour a place protected from the winds and waves so as to afford shelter for shipping. The term may be sub-classified into those harbours which are accessible at certain states of the tide only, and those which are accessible at all times and in all weathers. The former are known as ordinary or tidal harbours, and the latter as harbours of refuge, because they afford shelter at all times to vessels overtaken by stress of weather or requiring to effect some repairs, thus avoiding the risk and wear and tear of keeping to sea during an on shore gale and the delay of putting back to port. That harbours of refuge contribute very materially to save both life and property on our coast, is fully attested by the numbers of vessels that may be seen during stormy weather anchored in perfect safety within the shelter of the breakwaters of Holyhead, Plymouth, and other ports.

It is obvious that in crowded and confined seas like our own, harbours accessible at all states of the tide, and in all weathers, should be at frequent intervals along the coast. During storms, when vessels can only reach those ports which are under their lee, it is evident that the greater the number of such ports—affording easy access and shelter at all times – the greater will be the safety of life and property on our shores.

By a cursory glance at the configuration of our coast it would almost seem that with our bays and bold projecting headlands, such places of shelter already exist naturally. But on examination we find that where shelter is obtained there is insufficient depth of water for a vessel to ride at anchor at all states of the tide, or where we find ample depth of water it is only partially sheltered, and perhaps too far away from the track of passing vessels. Thus it is

that we are called upon to complete by artificial means those features that exist naturally in a more or less perfect state, either by constructing breakwaters or piers to obtain sufficient shelter, or by resorting to dredging for the removal of shoals to acquire ample depth of water at all states of the tide.

In connection with harbour works, it would be manifestly absurd to generalise or advocate any particular mode of procedure or disposition of structure that would be applicable to all circumstances and localities. No works whatever require more careful consideration and skill, or are attended with more aggravating consequences when hastily or improperly devised.

Of course shelter may be obtained in a broad expanse of sea by constructing an isolated breakwater in the midst of the bay, as at Plymouth, or by running a pier from the land out into deep water; but if the prevailing winds and the set of the tides are not carefully considered, serious complications of tidal currents may be the result, and the harbour instead of being a place of shelter easy of access, will be only a trap for the accommodation of shoals and a terror to the mariner.

In addition to possessing ample depth of water and good sheltered anchorage at all times, it is obvious that a harbour of refuge should be particularly easy of access; greater facility should be afforded for the entry of vessels than for their departure, because during an on-shore gale when vessels seek the protection of a port on their lee, manœuvering at the entrance might result in their missing the harbour altogether and becoming wrecks on the lee-shore, whereas when once inside and anchored in safety they can very well remain there until the storm has abated.

In the standard type of breakwater the substructure is formed by depositing stone in the rough state along the site of the work, either by tramways from the shore or by hopper barges directed in position by beacons or landmarks; a huge mound is thus formed which after exposure to the action of the sea for some time becomes consolidated and assumes a certain form. Within the limits of the tidal range the materials are disposed of in the form of a long flat slope similar to a beach; below low

water mark the slope becomes steeper, about 5 horizontal to 1 vertical for a depth of 15 feet; from this change of inclination to the bottom, no matter how deep, the slope assumes a much steeper character, varying from $1\frac{1}{2}$ and 2 horizontal to 1 vertical. The general uniformity in the depth at which these rubble mounds assume their final change of inclination, tends to confirm the opinion that the disturbing action of waves on our coast does not extend lower than 15 feet below low-water mark. It has been exemplified, however, after the completion of some of our breakwaters, that the disturbing action of the waves extends about 5 feet lower or to a depth of 20 feet; but this is no doubt owing to the recoil and increased agitation—produced by the upright face of the superstructure.

Instead of the upright wall as adopted at Holyhead, Portland, and Alderney, the superstructure of the Plymouth breakwater presents a sloping face to the sea. It is evident that a sloping face is less exposed to the violent shocks and blows of the waves than an upright wall; waves in rushing up a slope are allowed as on a beach to expand and exhaust themselves gradually; whereas on striking an upright wall they act like a ram and tend to overturn the structure, but at the same time the effort of the wave is more effectually destroyed.

The force exerted by waves in exposed positions is very considerable, and sometimes forms an important element of consideration in reference to harbour work. It is generally assumed that unbroken waves never exceed, under any circumstances, 43 feet in height or 560 feet in length, and that their power of destruction varies directly with the height. The latter depends upon what is termed the "fetch," or distance from the weather shore; and, according to Mr. Stevenson, it is approximately, in feet, equal to once and a half the square root of the fetch in nautical miles. From this, it seems that at a distance of about 800 miles from the weather shore waves attain the maximum height. Now, the heaviest gales recorded at the Liverpool Observatory during the year 1874 and 1875, were from W. S. W., and their force was respectively equal to 50 and 70 pounds per square foot of flat surface. With such gales here, the Isle of Man, distant about 30 miles, would form

the weather shore. The height of unbroken waves, due to that fetch, would be about 8 feet 3 inches; but if the storm veered to W. or S.W., the Irish coast would then form the weather shore, and the resulting waves would be nearly twice as high. These are, of course, unbroken waves in deep water, and not the concentration or heaping-up of energy we see on a shelving beach during an on-shore gale, dashing against cliffs and leaping into the air 100 feet high.

At Skerryvore, a point on the west coast of Scotland, exposed to the full fury of the Atlantic, waves were observed to exert a force of three tons per square foot, and on the shores of the Shetland Islands, blocks 23 tons weight were transported by the waves a distance of 30 feet, and then broken into fragments.

In modern harbour-works advantage is taken of the employment of large concrete blocks to resist the destructive force of the waves. Blocks weighing 350 tons each are now employed with success. These are formed on shore, and as each block becomes set or hard it is conveyed to its destination in a barge provided with a derrick and powerful machinery, by which it is lowered into position when the bed or substructure is levelled to receive it. The advantage of employing such huge blocks is chiefly that several linear yards of structure are laid in one operation, reaching above low water mark, and capable of resisting the force of the heaviest seas. Concrete, in the liquid state, is also extensively employed. In some instances it is formed in bags of 100 tons each, in others it is unprotected and lowered in skips or boxes, the bottoms of which are provided with butterfly doors, and opened by means of a trigger, worked from a stage above water. The chief advantage of these modes of procedure is that the concrete in the liquid state conforms readily to the natural bed of the sea or substructure upon which it is deposited, thus dispensing with the manual labour under water necessary in setting large blocks; and, further, the structure, when complete, is more monolithic, or free from joints and weak places.

Works in connection with tidal harbours, require to be even more

carefully studied than those further seaward in deep water, which allow a wider margin for contingencies. By constructing piers in comparatively shallow water, and within the tidal range, we form abrupt projections from the general outline of the shore ; the effect of thus interfering with the tidal or littoral currents is always problematical, and if they are not so governed or modified that the silting tendency of the flood tide is fully counterbalanced by the scour of the ebb, the result may be very prejudicial to the normal condition of the port.

At the entrance to some harbours, a phenomenon may be observed due to the interception of the tidal and shore currents, and it is sometimes very clearly defined at the entrance to Whitehaven Harbour, (see Plate.) During the ebb, the current setting south from Redness Point is intercepted by the outflow from the harbour ; the curve of mutual counteraction of these two opposing forces is frequently defined by a zone on the surface of the water, which attains its maximum convexity towards the sea during the first half of the ebb, when the depth and momentum of outflow is greatest. The convexity of the curve towards the sea, clearly shows that the tendency of the shore current to set into the harbour, is overpowered by the outflow of the ebb. Now if we formed a secondary outlet for the tide so as to diminish the momentum of outflow at this point, the curve of mutual counteraction would then probably become convex towards the harbour instead of towards the sea as at present, thus indicating the set of the shore current into the harbour, carrying with it the sand or other matter held in suspension ; deposition would ensue and periodical dredging would be necessary to maintain a navigable fairway.

Piers to afford shelter from the prevailing storms, such as the West Pier, (see Plate) are generally formed polygonal in plan or constructed in a series of cants, terminating with a bold pier-head. This not only gives the structure increased lateral stability, but, in addition, the cants or elbows change the direction of the waves, and finally the bold pier-head checks the fetch of the sea across the harbour mouth, which might otherwise sweep the vessels to the lee-ward of the entrance.

When the pier-heads are disposed so as to form a funnel mouth contracting inwards, such as the entrance to Whitehaven Inner Harbour, they tend to produce increased agitation within ; because, as the waves roll in between the outer shoulders of the piers, instead of being allowed to pass on freely to spread and exhaust themselves gradually, they are contracted and increased in height, or in other words a heaping-up of energy takes place between the piers, which is forced through the contracted passage by the following waves, thus producing a chopping and agitated sea inside.

In the disposition of the quays and jetties in a harbour on an exposed coast, sufficient space should be allowed for the evolutions of vessels driven in whilst under sail. Facilities for railway traffic are frequently important elements of consideration ; and where sheds or warehouses are required for the protection of perishable articles, the width of the quays must be regulated accordingly.

In constructing the quays, it is usual to take advantage of the increased stability afforded with a sloping or battering frontage, but in tidal harbours, where vessels frequently lie abreast, it is manifest that the batter must be very limited, otherwise a vessel in the inside berth might get nipped during the fall of the tide between a deeper-laden vessel and the face of the structure.

The expansion of traffic at a tidal harbour is frequently met by constructing open-piled timber jetties, which, though not so lasting as stone structures, are less costly, and possess the advantage of affording additional quay space without encroaching to any prejudical extent upon the water area or tidal volume of the harbour. Cheap structures of this class readily meet the demands of increased traffic, and encourage its development to such an extent that it becomes absolutely necessary to have dock accommodation in which vessels can be loaded and discharged, or moved about at all states of the tide. It is indispensable to the commercial prosperity of a seaport to possess dock accommodation in which vessels can float at all times, so as to avoid the risk of taking the ground when deeply laden, particularly after the

structural fatigue of a long and tempestuous voyage. Vessels have frequently to carry weights far in excess of their own and unequally distributed, so that when a long steamer takes the ground, it involves the risk of impairing the rigidity of the hull and the adjustment of the machinery.

A century ago the area of the Liverpool docks was only about 13 acres; now the docks form an unbroken chain of six miles in length, and the value of the imports and exports for the year 1874 reached the enormous amount of £667,733,165. At present, extensive works are in progress to meet the requirements of the increasing commerce of the port; similarly at Hull, Glasgow, Bristol, and other places.

The wonderful change that has come over the character of our shipping must be considered with reference to the proportions and details of modern docks. In 1860 the number of vessels registered as belonging to the United Kingdom, consisted of 25,663 sailing vessels and 2,000 steamers; in 1874, the number of sailing vessels decreased to 21,464, and the number of steamers increased to 4,033; or in other words, while the number of sailing vessels had decreased, the number of steamers had doubled; but instead of the tonnage simply doubling as well, it increased from 454,327 to 1,870,611 tons, thus showing that steamers are now not only twice as numerous, but twice as large as they were fifteen years ago. This increase of tonnage in the modern steamship is not so much due to increased depth or beam, entailing wide and deep entrance locks, as to increased length; so that instead of providing dock accommodation for the comparatively short bluff vessels of the past, we are now required to afford accommodation generally for steamers long and thin in character, and, in some instances, exceeding 500 feet in length.

The construction of docks in a tidal harbour is sometimes attended with many difficulties and obstructions. In the majority of cases, the difficulties and delays attending tide-work are overcome by constructing a coffer-dam, so as to exclude the tide from the area of operations; but, of course, in ports where the existing accommodation is very limited, this preliminary step is impracticable, and in consequence the work

assumes an intermittent and tedious character. The difficulties attending unfavourable strata in the foundations are readily overcome by driving piles or sinking concrete cylinders. The latter have been used very successfully on the Clyde for forming the substructure of quay walls reaching 20 feet below low water mark.

Where space will permit, it is usual to form a Lock at the entrance to a dock with a double pair of gates, the distance between which is regulated by the class of vessels frequenting the port. At high water the inner gates are closed, so as to maintain the water level in the dock, and thus prevent the possibility of the larger class of vessels within taking the ground. The outer gates may be kept open so long as there is water enough in the harbour to admit a vessel. If one should arrive and wish to enter the dock, she is moored in the lock, the outer gates of which are then closed. The water level in the lock is then raised to that in the dock by means of sluices through the inner gates or side walls; when this is done, the inner gates are opened, and the vessel allowed to enter the dock. The reverse operation of passing a vessel out is performed in a similar manner. In some cases an outer, or what is termed a "Half-tide Dock" is provided, capable of holding several large vessels and which, in addition, is used as a dock proper by the smaller class of vessels. By fixing a pair of gates at the entrance to Whitehaven North Harbour it could be utilised as a half-tide dock and kept open for shipping an hour after the gates of the inner dock were closed; during which time a spring tide would have ebbed about 2 feet 4 inches; this would represent the difference in level of the water in the inner and outer docks. But as they are about of equal area, by opening the inner gates to allow vessels to pass in, the general water level would be reduced only one-half the original difference in level, or 1 foot 2 inches.

In a busy harbour the advantage of a lock or half-tide dock is manifest, but in an important seaport with a long chain of docks it is almost indispensable. Vessels arriving late during the tide, having been delayed by fog or stress of weather, are passed through to their appropriated berths and enabled to discharge their cargoes of perishable goods and leave by the next tide.

Lock gates of large span are generally so constructed that when closed they form an arc of a circle, thus producing tightness or compression at the meeting posts and side walls, tending to prevent leakage. With gates of medium size this is obtained by making them meet at an obtuse angle, so that when closed against the water pressure they mutually strut each other, and moreover the opening and closing of the gates is facilitated. The entrance to Whitehaven Dock is 50 feet wide; during a spring tide, the stress in direction of each gate is 233 tons and the resulting thrust on each side wall is 250 tons. With forces such as these, together with the hydrostatic pressure on the gate floor, it is evident that the work in the vicinity of lock gates requires to be not only massive but as impervious as possible.

Sluices or outlets are generally formed in the gates or side walls for the purpose of keeping the lock floor clean, and to counteract any shoaling or silting tendency in the vicinity of the entrance; their efficiency will, of course, depend in a great measure upon the volume and velocity of the water emitted. The latter is proportional to the square root of the depth of the outlet below the surface of the water; that is to say, with four times the depth the velocity will be only doubled. If the stream is opposed by a stratum of standing water the efficiency of the sluicing will be nullified, and it will only tend to create whirlpools and eddies.

In connection with harbours and wet docks it is necessary to have some place for the reception of vessels so that they can be examined and repaired in the dry. For this purpose the "Graving or Dry Dock" is the most popular. When a vessel is once in and the gates closed, the water is allowed to run out, or is pumped out by steam power, according to circumstances, thus leaving the dock perfectly dry until the vessel's repairs are complete, when the water is again admitted and the vessel floated out. Other means are adopted for repairing vessels in the dry, or free from the flow of the tide, such as the "Patent Slip," the "Hydraulic Lift Dock," and the "Floating Dock." The Patent Slip is only used for vessels of medium size, and consists of a cradle with rollers, upon which the vessel is laid and then drawn up an incline beyond high water mark. One of these may be seen in use at the south side of the Whitehaven Harbour.

The "Hydraulic Lift Dock" consists of a platform, formed by pontoons connected to a row of pillars or hydraulic presses on each side. When a vessel requires to be docked, valves are opened to admit the water into the pontoons so that the platform may sink to the required depth, the vessel is then hauled over it and shored. The platform and vessel are then lifted by means of the hydraulic presses on each side; at the same time the water is allowed to escape from the pontoons which are then sufficiently buoyant to support the vessel above water.

The "Floating Dock" consists of a hugh iron pontoon formed like an ordinary Graving Dock; when required for use, valves are opened to admit the water, and the structure gradually sinks to the required depth to receive the vessel, which is floated into it and shored. The water is then pumped out by steam power until the floor of the dock is above water; it can then be moved to any suitable position. For general purposes it is evident that the ordinary Graving Dock has the advantage of all these systems, the vessel when once inside and shored in the dry is free from accident and the risks attending mechanical complications; moreover, the vessel is uniformly accessible both for workmen and materials at all times, being in no way affected by the rise and fall of the tide.

Hydraulic machinery is now extensively used in connection with docks, for the working of cranes, opening and closing the gates, turning swing-bridges and capstains. The pressure is obtained by load instead of by elevation, and is generally that due to a head of water 1,500 feet high, or about 700 lbs. per square inch. This is produced by means of pumping by steam power against a column of water supporting a loaded piston termed an accumulator. The water pressure is transmitted from the accumulator to the several machines around the docks, by means of pipes laid under the surface of the quays, and the exhaust water is sometimes brought back in return pipes to the pump-well and used over again.

On the Mersey Dock Estate hydraulic machinery is very extensively employed, and the arrangements carried out in connection with the ware-

housing and transmission of grain are beautiful examples of mechanism. The grain is lifted in a huge tub from the hold of the vessel to the top storey of the warehouse. It is then emptied into a hopper and glided on to an endless travelling band, upon which it is transmitted horizontally to any part of the building; by a deflection of the band the grain is diverted on to another band travelling in a different direction, or cast into a hopper from which it can be distributed on any of the lower floors by means of down spouts. "Dredging Elevators," and "Revolving Screw Creepers" are sometimes used for the warehousing and transmission of grain in connection with docks, but they absorb, proportionately, an enormous amount of power, and, moreover, the grain suffers by attrition, whereas with the travelling band the condition of the grain is improved by the current of air in transmission.

The advantage of hydraulic machinery in connetion with a system of docks, or where a multiplicity of mechanical appliances is necessary, is now fully attested by its general adoption at all the principal ports of the kingdom.

Mr. Williams, in reply to Mr. Martin, then described the discovery of the fact that the foundation of a portion of the west wall of the dock (Whitehaven) was bad on account of the action of Bransty Beck on the gravel bed on which it was built, and he described the process by which it was overcome. In reply to Mr. Russell—who asked how it was that, the current from the harbour during the ebb of the tide being stronger, as illustrated by Mr. Williams in his paper, than the current flowing into the harbour from Redness Point, there was an accumulation of silt within the West Pier—he said that it being found that the accumulations in the harbour were very considerable, the attention of Sir John Rennie was drawn to it. Before the North Pier was built the sand came right inside the curve of the West Pier, and Sir John Rennie recommended that the North Pier should be carried out simultaneously with the West Pier. The Trustees in their wisdom did not do that, and he understood it silted up comparatively little since the building of the North Wall.

In reply to MR. SNELUS, who asked whether Mr. Williams had directed any attention to the utilization of slag in dock works, Mr. Williams said that he would only use it for mixing with concrete or rubble in walling. MR. SNELUS said they had been successful at the West Cumberland Iron and Steel Works in employing it as a concrete, and had built a river wall on the Derwent entirely of it.

THE CUMBERLAND DIALECT.

By John Richardson, (St. John's Vale, Keswick.)

As the Cumbrian is only one among a great number of dialects which are spoken in Britain, each of which differs more or less from the others in pronunciation and idiom, it perhaps may not be out of place, by way of introduction to the subject under consideration, to glance at the probable origin of the dialects in past times, and the causes of the slow but gradual disuse which they seem destined to fall into in the future.

No one who has thought at all on the subject can fail to see that the origin of so many different modes of speech in this country has been principally owing to the absence of a written language, and, in a less degree, to the imperfect means of communication which existed in primitive times between one district and another. It is little more than four hundred years since printing was first introduced into England, and although there might be printed books a few years sooner, and manuscripts some centuries earlier still, these, besides many of them being in Latin, were so extremely scarce and inaccessible that there could not be said to be any written language available to the common people, among whom the dialects originated, until towards the end of the fifteenth century.

Now, it is supposed that the first inhabitants of Britain were Celts, who crossed over from Denmark about five or six centuries before the Christian era; and, assuming this to be correct, there was a period of more than two thousand years during which the people of this island had no written language, and consequently no fixed standard of speech—a fact which is of itself quite sufficient to account for all the variations and irregularities which have prevailed.

Setting out with the assumption (which is by no means certain) that the first settlers all spoke the same language, or dialect, which would of course be Celtic, we can easily imagine how, in the course of time, when

the coast where they had first established themselves became over-populated, parties would wander off from the main body, and go in search of other favourable situations, where they would build their huts and form separate communities ; how in these new settlements any word which by chance got a different pronunciation, or any new phrase or idiom started by one, would be imitated by the rest, learned by the children, and so perpetuated ; how other words and phrases would follow, and other colonies branch off to other parts of the island. And when we reflect that Britain was then a vast wilderness, without roads or means of communication between the different settlements, we can easily understand that in the course of ages every district would have a community in a great measure isolated from the rest, with a dialect of its own. How these dialects were acted upon and modified in after ages by successive incursions of new comers from different parts of Europe is a subject beyond the range of this paper. No doubt many of them were almost entirely changed in their character, but that they were never totally obliterated is evidenced by the numerous Celtic words and roots which still remain in all of them. We may, however, observe that the dialects would not all be acted upon in an equal degree. For instance, in the southern parts of the island, where the German intruders were most numerous and longest established, the Anglo-Saxon would become the dominant tongue. In the Northern parts the Danish and Scandinavian elements would prevail ; while in the more inaccessible districts such as North Wales, the Celtic would remain almost unchanged.

As, therefore, there can be little doubt but that the great diversity of speech in this country arose, as has just been stated, from the absence of a written language, and the imperfect means of communication which formerly existed between one district and another, it would seem to follow as a natural sequence, that, these wants having been supplied, the dialects would quickly die out. How is it, then, it may be asked, that many of them and notably the Cumbrian, are nearly as vigorous as ever? In replying to this question, and taking the Cumberland as the dialect with which we are best acquainted, we may observe that though books, periodicals, and newspapers, are now so plentiful and cheap as to be easily

obtained by every one, and although the means of travelling and postal communication have become almost perfect, the people who speak the dialect in the rural parts of the country have hitherto as a rule, neither read, written, nor travelled. There is, however, a marked change taking place in this respect. Newspapers and books are becoming far more common in country houses; and it is probable that as our dream of general education becomes gradually realized, old prejudices will be given up, old habits laid aside, and at some future time the rural inhabitants of Cumberland may perhaps converse together in the ordinary Queen's English. The intention of this paper, however, is rather to treat of the dialect as we find it, than to inquire into the changes it has undergone, or to speculate upon the length of time which may elapse before it is entirely laid aside. It will therefore be limited in a great measure to the two questions—"Where is the dialect spoken at the present time?" and "What are its chief distinctive characteristics?"

To the first question, "Where is the dialect spoken at present?" we may answer: It is spoken under one form or another over all the agricultural and pastoral districts of Cumberland, and by the common people in the towns as well, but only in its pure state towards the middle of the county, being mixed with other dialects around the outsides. This may be accounted for in the following manner. In former times, when England and Scotland were separate kingdoms, and almost constantly at war with each other, there was a strip of land, a few miles in breadth, stretching from Berwick, on the German Ocean, to the Solway Firth, which was called the debateable ground, being a sort of overlap of the boundary; and this land was claimed by both nations, but could not properly be said to belong to either. Now, something similar to this happens, wherever two districts meet in which different dialects are spoken. There is a sort of overlap, where the words and phrases have become so blended and intermixed, that the folk speech cannot be said to belong exclusively to either district. Hence, in that part of Cumberland bordering on Scotland, from the Cheviot Hills on the east, to Silloth on the west, the dialect is half Scottish. In the higher part of the dales, such as Borrowdale and Wythburn, which run up to the southern boundary of

the county, it is mixed with that of Westmorland. In the east, towards Crossfell, it has many Northumbrian words; while in the west, of late years, since the iron manufacture has become so much developed, the Cumbrian, Irish, Welsh, Cornish, and other dialects, have become in some instances rather awkwardly jumbled together. It is, therefore, only in the central part of the county that the Cumberland dialect is spoken in its purity; and this central part may be defined as a tract of country surrounding the Skiddaw and Blencathra range of mountains, and extending about fifteen miles east and west from their base, and some five or six north and south.

To those persons who have always looked upon the dialect as something exceedingly vulgar and outlandish, it will no doubt appear paradoxical when we refer to its being spoken in its purity. It will therefore be as well to observe here that there is nothing necessarily vulgar about it. One may be vulgar either with or without it. There are some people excessively vulgar who do not speak the dialect, while there are others who use no other form of speech who have not a particle of vulgarity about them. They make quite as great a mistake who think that all dialect words are corruptions, or wrong pronunciations of ordinary English. On the contrary, there can be little doubt but that a great many words now used in standard books, were formerly so used exactly in the form in which we now find them in the dialect, but have since been modified and altered to suit our modern ideas of speech. In proof of this, if we look into the writings of some old authors—books which, no doubt, were standard works at the time they were published—we find numbers of old words written in just the same way as they are now used in dialect writing; and it is quite possible that many old dames, who have spent all their lives up in the dales, could give a much more sensible explanation of some doubtful passages in Chaucer than many learned members of the Philological Society.

We will, however, proceed to point out a few of the peculiarities of vocalism and idiom which render the dialect so difficult to understand by persons not acquainted with it. One of the first things that will strike a stranger on hearing it is the way in which the double vowel or

diphthongal sounds vary from the ordinary English. The proper diphthongal sound of "ou" or "ow" is changed to that of "oo" : thus, house becomes "hoose"; cloud, "clood"; round, "roond"; and so with "ow," cow is "coo"; now, "noo"; how, "hoo"; and so on. Then such words as have the "oo" sound in ordinary English require "eu" in the dialect: book is "beùk"; look, "leùk"; school, "scheùl"; and fool, "feùl." Again such words as in the English have the long "o" and "oa" sound, are sometimes pronounced in the dialect as if spelt with a "w," so that note is "nwote"; coat, "cwoat"; and boat, "bwoat"; but sometimes the long "o" is changed into the proper diphthongal sound of "ow," so that brought is "browt"; thought, "thowt," &c. The sound of the long "i," too, is often changed to that of "ee"; and right is "reet"; light, "leet"; bright "breet"; and so on. The short "e" also is occasionally changed to the long "e," when head becomes "heed," and dead, "deed." Passing from the vowel sounds, we will proceed to notice some other peculiarities of pronunciation. In the dialect the termination "en" is invariably used instead of "ing"—thus writing is "writen';" walking, "walken';" working, "worken'," and so on. The dental sound of "th" is seldom heard in the dialect either—as: father is "fadder"; mother, "mudder"; and brother, "brudder"; twentieth is "twentit"; and thirtieth, "thirtit." Even in the article "the" the "th" is not sounded. Instead of saying "The master and the mistress," a Cumbrian says "T' maister an' t' mistress." "And" is always contracted to "an," "thee" to "the'," and "with" to "wi'": thus, the sentence "I will go with thee," is shortened to "I'll ga wi' the'."

It will be seen from these few examples, that in the Cumbrian pronunciation there is a marked tendency to contract, or shorten the words, a tendency of which many more specimens might be given, such as "slape" for slippery; "flate" for frightened; "'pleen" for complain, and such like. The few words we have noted will, however, be sufficient to give a fair idea of the Cumbrian vocabulary, and therefore we will next glance at a few of its idiomatic peculiarities. Perhaps the most noticeable thing about the way in which the dialect is spoken, and its worst feature, is the total disregard which the speakers have for all the rules of grammer. They use pronouns in

the objective case instead of in the nominative; and singular verbs instead of plural ones in almost every sentence. Instead of saying "He and I are going," a Cumbrian says, "Him an' me's gaan." They do not use the possessive case of proper nouns at all. Instead of saying "George's cow and Harry's horse," they say "Gwordie coo and Harry horse." Then they have an odd way of omitting the object of a sentence, and leaving it to be guessed at. They will say, "They're gante wesh," or "They're gante clip," without saying whether they are going to wash clothes, or the sheep, or themselves; or whether they are going to clip the sheep, or a hedge, or something else. The anecdote told by the butcher was an instance of this kind. A butcher went to a farmhouse to ask for his weekly order, when the old dame said to him, "Nay barn, we'll nut want enny this week, we're gante kill oorsels." That did not mean that they were all going to commit suicide, and so would not require any more meat, it simply meant that they were going to kill a sheep of their own. They sometimes confound quantity and numbers in a droll way, too. They will say, "A few poddish" or "A few broth," but they would laugh at you if you said a few water, or a few milk. Although these and other peculiarities of the idiom, which might be pointed out, render the dialect almost unintelligible to strangers, they are so perfectly familiar to those who speak it, that they do not hinder conversation in the least. Only give two or three Cumbrians some subject of dispute—for instance, the merits or demerits of some particular horse or cow,—and they will argue the different points with as much energy, and as fluently, as if they had all the rules of Lindley Murray by heart. Indeed it is when listening to an argument, or "fratch" as it is called, that one may pick up some of the broadest and richest specimens of the dialect. It will be seen, however, by all impartial critics that the irregularities we have mentioned are simply corruptions and excrescences, which no more affect the real character of the dialect than the bad English of uneducated Londoners, or the coarse slang of the American rowdy affect that of the English language itself.

We will next notice some of the redeeming traits of the dialect. Chief among these are its conciseness and its expressiveness. We have

already referred to the shortness of Cumbrian words, and pointed out how monosyllables in the dialect are frequently synonymous with ordinary English words of two or three syllables; and when we consider that, besides this, many of the phrases, too, are extremely laconic, it is easy to understand that a Cumbrian requires far less time and breath to express his ideas to his neighbour than would be required to do it in Queen's English. Take, for example, the questions, "Where are you going?" "What are you doing?" and "What is the matter?" It will be observed that each of these questions consists of five syllables, whereas, in the dialect, they only require three each, thus, "Where's te gaan?" "What's te deùn?" and "What's t' matter?" Numerous examples of this kind might be given; but as the above will give an idea of our meaning, we will proceed to make a few observations on the expressiveness of the Cumbrian mode of speech. We cannot illustrate this part of the subject better than by giving a few specimens of the short says with which the folkspeech of Cumberland abounds. Indeed, there is hardly a circumstance or incident in the lives of the dales people, but there is a figurative phrase of some kind applicable to it. Here are a few. If a person is thought foolish they will say, "He's nobbut hofe rock't," or "He's as thin as a cat lug." If one is slow in his movements, they say, "He'll gang farder i' two days ner yan." When an old courtship is renewed, they say, "Auld ke'all ur seuner warm't nor newens meàde." If a man marries for money, they say, "He's weddit t'middin for 't seàke o't muck." If a person is not to be depended upon, "He's not to ride a watter on." If an insignificant person has had a narrow escape, it is said "That 'at's nowt's niver i' danger." If a person is cross and cantankerous, "He's as creuk't as a tip horn." If one is sly and deceitful, they say, "Smooth water runs deep." We might go on quoting these old saws, but the few specimens given may serve to give some notion of their character, and though many of them may not be so very refined, we must at least admit that they are uncommonly expressive and much to the purpose.

Alluding, in a former part of this paper, to the corruptions and irregularities of speech which abounded among the dialect-speaking people

of Cumberland, we remarked that such irregularities were no obstacle in the way of conversation, but to any one attempting to write in the dialect it is very different. In composition (even in the dialect,) a writer is obliged to pay some attention to the laws of grammer, and consequently is prevented from writing many of the most common and striking phrases exactly as they are spoken; and although the pronunciation may, as a general rule, be pretty clearly indicated by means of phonetic spelling, there are some words in use the sound of which it would be impossible to give a correct idea of on paper by any combination of letters.

It may perhaps be asked, "But what is the use of writing in the dialect at all? If people will write, why not write in ordinary English?" Well, perhaps it is fancy as much as anything. Tastes differ so much, that it is said there is no accounting for them. Talents differ very much, too. People who do write ordinary English have very different ideas. One writes prose, another poetry. One truth, another fiction. One songs, and another sermons. But there may also be utility in dialect-writing. If, as we surmised at the beginning, the Cumbrian mode of speech is destined to die out in the course of two or three generations, it may be desirable to preserve as many specimens of it as we can, from which our grandchildren and greatgrandchildren may see the rough and homely garb in which their forefathers were wont to clothe their ideas. And further, the peculiar manners, traits, and above all the humour of Cumbrians may be far more forcibly depicted in the dialect than in any other way. If any one wishes to know about the manners and customs of the people who lived in this county towards the latter end of the last and beginning of the present century, he will do well to read, not Nicholson and Burn's or Hutchinson's History of Cumberland, but the dialect writings of Anderson, Stagg, and others. From the songs and ballads of these writers, one may get a far better insight into the pecular traits and rough manners of the Cumbrians of that time than from any other source whatever.

Our old border county has been peculiarly rich in native writers. Not to speak of Wordsworth and others, who have distinguised themselves in the higher walks of literature, Cumberland has never, for the last one hundred and fifty years, been without its dialect writers; many of whom

have enjoyed a large amount of local popularity. The first who attempted to rhyme in the vernacular (of whom we have any authentic record) was the Rev. Josiah Relph, of Sebergham, who died in 1743. He was followed in succession by Evan Clark, of Wigton; Miss Gilpin, of Scaleby Castle; Miss Blamire, of Thackwood; Blind Stagg, of Burgh-by-Sands; and Robert Anderson, of Carlisle. The last has been commonly styled the Cumberland Bard, and has been the most popular of all the dialect writers. Then, there were Mark Lonsdale, John Rayson, and Woodcock Graves; and there was Alexander Craig Gibson, who, I have no doubt, was personally known to some here present. There are still living Mr. William Dickinson and Miss Powley; so that we have a continuous chain, or succession, of dialect writers, stretching from Relph to the present time.

It may be that but few educated persons take much interest in the dialect, nevertheless, if entered into without prejudice, or affectation, the study of it, as the study of most other things, may become very interesting. I have in my possession a letter which I received from the late Dr. Gibson, two or three years before his death, in which he styles it our "Grand old dialect;" and when we reflect that, to the people of Cumberland, it has for hundreds of years served every purpose for the interchange of their ideas; that they have ever found in it words and phrases which were amply sufficient to express every emotion of their minds; that in it they have told their joys and their griefs; their hopes and their fears; and that in it they have sung their loves and their sorrows, their sports and their rejoicings,—I think that if we do not go so far as Dr. Gibson, to style it our "Grand old dialect," we may, at least, respect and value it as an old and faithful servant.

(The CHAIRMAN afterwards observed that the author had alluded to writers in the Cumberland dialect past and present, but his modesty had not permitted him to tell them that he himself was one of the foremost dialect writers of the day. Mr. Richardson's book was one of the very best that had been issued, and was remarkably free from the errors that some of the writers in the dialect had fallen into. They were very much indebted to Mr. Richardson for his paper.)

SKETCH OF THE GEOLOGICAL HISTORY OF THE LAKE DISTRICT.

By J. Clifton Ward, F.G.S., Assoc. R.S.M., of Her Majesty's Geological Survey.

Whenever we wish to draw up an account of the history of any particular period, our first care is to search out all the old parchments and examine all the records that have been preserved in library and museum. And when we wish to learn the geological history of any particular district, our first care is to examine carefully the rocky volumes of that district, to unroll its time-worn parchments and decipher their faded and half-obliterated characters.

No more interesting tract of country could we thus enquire into than our English Lake District, and we shall find, I doubt not, that its past history adds another charm to its present scenery.

In Fig. 1 I have drawn a diagrammatic map of the district showing the relations of the various rock-groups to one another, and how the older (A to C) are enclosed in a frame—somewhat broken on the south—of the newer Carboniferous (D) and Permian (E). Fig 2 is a horizontal section taken through the area from north to south (N. to S.) In these figures (and in Fig. 3), A—Skiddaw Slate, B—Volcanic Series, C—Coniston Limestone and Upper Silurian, d—Conglomerate, D—Carboniferous, and E—Permian.

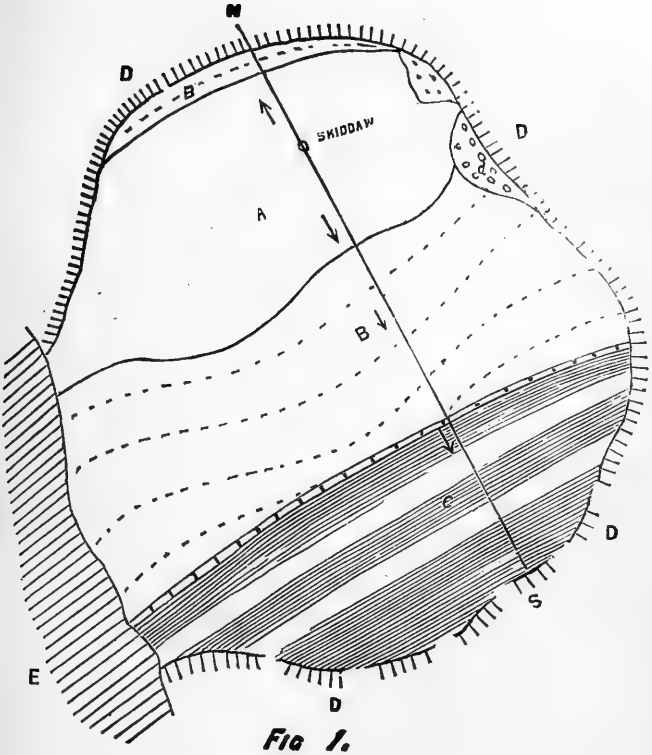


Fig 1.

Fig 2.

Lowermost, we have the Skiddaw Slate group, a great thickness (some 8,000 to 10,000 feet) of old muddy and sandy deposits, indicating general shallow water conditions, and containing remains of marine organisms. Such a sequence of beds indicates a continued subsidence of the sea bottom, thus allowing the accumulation of so great a thickness of shallow-water deposits. It is quite impossible to estimate the length of this period—as impossible as it is to conceive of the distance separating us from our central luminary. But at last the records of this first volume of our geologic history cease or pass upwards into those of volume two. It would seem that those mysterious forces from below began to seek some outlet, and a line of weakness being found, a volcanic vent was opened out. The earlier eruptions were clearly sub-marine in character, for we find muddy deposits interstratified with beds of volcanic lava and ash, but soon the shallow sea became filled up, or a moderate elevation helped to convert the sub-marine volcanoes into sub-aerial ones. The great series of volcanic deposits now piled up above the Skiddaw Slates, and forming our second volume, may be estimated at 10,000 or 12,000 feet, but as we know that volcanic activity is very variable in its nature, it is not easy to form an idea of the duration of the period, which, however, may have been far shorter than the preceding.

We next come upon a gap in our records; a long period of time elapses, during which no volume is inscribed, but, on the contrary, portions of the previous records destroyed by denudation, so that when the volcanic tract of land has subsided fairly beneath the sea-level, the succeeding marine deposits are laid down upon an irregular and denuded surface. These marine deposits consist of the Coniston Limestone and Upper Silurian grits and slates, the whole having, according to Mr. Aveline's estimate in the Kendal district, a thickness of no less than 14,000 feet. Once more, then, we find the evidence of the continued slow subsidence of the sea bed sufficient to allow of the accumulation of this great thickness of deposits. The fourth volume (the third being wanting) of our history may be formed of very similar materials to those composing our first, but the nature of the writing has in great part changed, just as the characters used in a fourth century manuscript may be distinct from, and

more highly developed, than those in a manuscript of the first century. The fossils in the Upper Silurian are higher in character than those of the far older Skiddaw Slate period.

Again we find another gap in our records; those internal forces before spoken of begin to re-assert themselves, but being unable to burst through their rock-bound prison, produce a vast and probably slow upheaval, throwing the various deposits forming our volumes one, two, and four, into great curves and contortions, a large portion being denuded and swept away as bed after bed is brought within the range of marine and atmospheric action, so that finally, even the lowest of these deposits is once more exposed to daylight, and a table-land, formed of the older rocks, appears as the nucleus of the future mountain district (fig. 3).

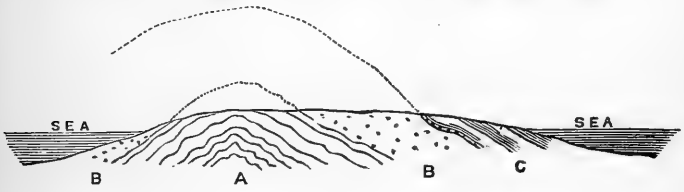


Fig 3.

Around this early nucleus are heaped up in certain areas great thicknesses of conglomerate and breccia, some of the stones of the latter perhaps indicating a more or less glacial character of climate, and these conglomeratic deposits are succeeded by those of the great Carboniferous period, formed in the seas surrounding the embryo mountain district, and affording evidence of a warm and more genial condition of things—our volume six. Here also we find that the fossils entombed in this series of rocks are greatly different from those found in the leafy deposits of volume four. The sixth century characters differ markedly from those of the fourth; but let us remember that in some other library, in some other district, fifth century manuscripts are preserved, containing those transitional forms of character, of organic life, which are missing in our own neighbourhood. Thus do physical evidence and the varied phases of

organic life both clearly point to that long period of time elapsing between the formation of the Upper Silurian (vol. iv.) and that of the carboniferous (vol. vi.)

But just as the length of time between the sixth century and the nineteenth is great in modern historic importance, so is that between the Carboniferous and the present vast in geologic significance. Yet, during the whole of that long series of past ages, I believe our early nucleus was above water, and under very varied conditions of climate, was being carved out by nature's tools—now ice and snow, now semi-tropic rains—into that lovely form we now behold. The atmospheric agents, as we see them at work, during our puny lifetime, seem weak indeed; but how vast this period during which they have been at work! To my mind it is not the great amount of denudation thus effected that is so surprising as the survival of any portion of that rough-hewn block of country turned out from nature's quarry in early Carboniferous ages. In our own time, geologically speaking, this district experienced, I believe, a very considerable change of level during the lapse of the most modern of glacial periods, but long ere these glaciers clothed the districts in mantles white, or glacial seas washed mountain foot, our mountains and our glens had received very much their present form.

Finally, let us remember that if we, in our literary aspect, preserve with so much care the mouldering manuscript of a long past age, we ought far more to venerate our weathered and time-worn mountain district, with its rocky volumes inscribed by the finger of God, and its grand old history, and take care that we allow not encroaching railway and utilitarian smoke to mar this ancient relic.

SUMMARY. (To be read from below upwards.)

18th. to 6th. cent. M.S.S.	Geological periods from the Carboniferous to the Present.
5th. cent. M.S. or Vol. V. *missing.*	Upheaval and enormous denudation with formation of early nucleus (fig. 3.)
4th. cent, M.S. or Vol. IV.	Prolonged depression and accumulation of Upper Siluian marine deposits (14,000 ft.)

3rd. cent.	M.S. or Vol. III. *missing.*	Depression of sub-aerial volcanic deposits beneath the sea, with deundation.
2nd. cent.	M.S. or Vol. II.	Period of great volcanic activity, volcanoes at first sub-marine, afterwards sub-aerial (12,000 ft.)
1st. cent.	M.S. or Vol. I.	Prolonged depression and accumulation of Skiddaw Slates, marine shallow-water deposits (10,000 ft.)

PART II.

Original Papers communicated to the Societies during the Session 1875-6, *and selected by the Association Council for publication.*

OLD BORROWDALE.

By J. Fisher Crosthwaite, (Keswick).

[Read in Borrowdale at a Field Meeting of the Four Societies of Whitehaven, Workington, Cockermouth, and Keswick, June 2nd, 1875].

The object of this paper is to bring together a few facts relating to the people who have inhabited Borrowdale, and the tenure by which the Dalesmen hold their lands. Viewing the Borrowdale mountains from Friar's Crag we used in our young days to take up the language of the patriarch and speak of them as "the utmost bounds of the everlasting hills." Many singular stories passed current among the juveniles as to the doings over the wall beyond Watendlath, which was supposed to be the world's end. The early writers on the Lake Country have made common cause in speaking of Borrowdale and its people in the most grotesque and exaggerated terms. One writer says the southern extremity of Derwentwater "is a composition of all that is horrible." "An immense chasm opens in the midst and is divided by a rude conical hill, once kept by a castle, beyond a chain of crags patched with snow and containing various minerals, overshadowing the dark winding deeps of Borrowdale." Clark in his survey of the Lakes is grossly inaccurate in his description of the people, but his stories have been repeated by nearly all the guide writers who have succeeded him, till very recently.

It is difficult to meet with any early records of so remote a place as Borrowdale. There is no mention of our parish in Doomsday Book. The manor on the western side of Borrowdale was given by one of the de

Derwentwaters to the Abbey of Furness. On the dissolution of the Monasteries it fell to King Henry VIII. and remained in the possession of the Crown till the 10th year of King James I. about the year A.D. 1613. While it was vested in King Henry the VIII. John Fyssher and Lancelot his son were bailiffs of the King and in the 33rd year of his reign they rendered an account headed—"Furness Monastery—Ministers Accounts.—Borrowdale in the County of Cumberland." They answer for rents paid, amounting to £29 14s. These rents were paid as follows :—viz., by John Hynde, 8s. ; Robert Udale, 5s. ; John Lambert, 5s. ; Nicholas Fisher, 8s. 6d. ; Thomas Fysher, 8s. 6d. ; John Fysher, for Rygge, 15s. ; the widow of John Fisher, 15s. ; the widow of Edward Fysher, 15s., and similar sums were paid by Oliver Fisher, Hugh Harrey, Christopher Harrey, John Fyssher and Lancelot his son, Hugh Youdale, John Udale, Gwydone Byrkehead, Miles Byrkehed, John Byrkhed and his son John. The widow of Wm. Burkehead, Nicholas Birkehead, Hugh Richardson, Christopher Byrkhed, John Brathwayte, Thomas Dyconson, John Jobson, Hugh Brathwayte and Robert and John Brathwayte.

King James sold the manor of Borrowdale to William Whitmore, and Jonas Verdon, gentlemen, both of London, in 1613, and two years later they sold it to Sir Wilfred Lawson, of Isel, knight ; John Lamplugh, gentleman, John Braithwaite, Robert Braithwaite, John Jopson the younger, Nicholas Dickinson, Thomas Birkhead, of Seathwaite, yeomen ; Charles Hudson, of Boutherbeck, gentleman; William Braithwaite, John Fisher the younger, John Jopson, Thomas Fisher, John and Robert Birket, Anthony Braithwaite and Christopher Vickars, of Seatoller; Daniel Heckstetter, of Rosthwaite, gentleman; John Birket, of Thorneythwaite; Janet Richardson, of Longthwaite ; John Youdale and Nicholas Birket, of The Chapel ; Edward, John, Christopher and Thomas Birket, all of Rosthwaite; Hugh Fisher and Gawen Harris, John Wood, of Skairness ; John Fisher, of Grange ; John Banks, of Stanger ; John Fisher and Timothy Fisher, of Hollows; John Lambert and Richard Hyne, of Manesty ; Wm. Howe, of Newlands, yeoman ; Wm. Braithwaite, of High House, and Christopher Braithwaite, yeoman. It is described in a document com-

monly known as the Great Deed of Borrowdale, as "all that manor of Borrowdale with the rights, members and appurtenances, and all those lands and tenements in Borrowdale aforesaid by particulars thereof mentioned to be of the yearly value of £28 10s., and all that Salt Well or Salt water within the Grange of Borrowdale, together with all Royalties," but they except and reserve to the said Wm. Whitmore and Jonas Verdon and their heirs, all those Wad holes commonly called Black-cawke within the commons of Seatoller, or elsewhere within the commons and wastes of the manor of Borrowdale aforesaid, with liberty to dig, work, and carry the same and other their appurtenances whatsoever. The purchase money was £25 2s. Thus the tenants became owners of all minerals and manorial rights excepting the Black lead, and each statesman is lord of his own estate, and cannot have his property invaded by any one to dig for minerals, except by his own permission. These ancient freeholds render the yeomanry more free than any other tenure of land, and the independence which it produces is a quality which the dalesmen are noted for.

Whitmore and Verdon sold the Black Lead Mine to John Lamplugh, gentleman, and Charles Hudson, gentleman, of Bowtherbeck. Lamplugh sold his share of the Wad Mines to John Bankes (father of Sir John Bankes) in the year 1622.

Camden says—"In this parish in Seatoller Fell is that famous mine of Black Lead or Wad, a mineral very scarce elsewhere to be met with." He calls it "that mineral earth or hard shining stone, which painters use in drawing their lines, and shading their pieces in black and white."

Robinson in his Natural History of Westmorland and Cumberland speaking of this mineral says:—"The most remarkable Mundic Vein upon these mountains, is that we call Wad or Black Lead. Its composition is a black pinguid, and shining earth impregnated with Lead and Antimony. The Ore is more valuable than either Copper, Lead, or Iron. Its natural uses are both Medicinal and Mechanical. It's a present remedy for cholick, and other complaints and for these and the like uses, it's much bought up by Apothecaries and Physicians, who understand more of its Medicinal uses than I am able to give account of."

Tradition says that the mine was discovered by the wind having blown up an ash tree by the roots. Although probably known for a long time before, it seems to have been wrought with great success after it came into possession of the Banks' family and their co-partners.

The mine has eight stages, Thirty Veins, Eight Pipes, and four great Sops or bunches of wad or plumbago as it is usually called. In *Winkles pipe* at the meeting of the Veins a Sop was discovered in 1812 which produced 87 casks of best lead for pencils and 495 casks of coarse lead, in all 582. The 87 casks of best lead alone would realize £24,360. The grand pipe which was the one discovered as before described was wrought to the depth of 64 yards to the top of Harrison's pipe. In 1778 no fewer than 417 casks containing about 70lbs. each, of the best quality, were extracted; this at 30s. per lb. would amount to £43,785. There were besides two other openings of this pipe in the ten years ending in 1788. In 1802—3, Dixon's pipe was discovered, when ore to the value of £98,742 was got. So valuable a mine needed more than ordinary protection. Consequently an Act of Parliament was passed enacting that any one breaking into the mine or picking Wad or Black-cawke at the rubbish heaps would be guilty of Felony. Notwithstanding, some black lead did find its way to Keswick, and Jews came regularly to the George Hotel to buy it. The owners had all the mineral taken to London and monthly sales were held at their warehouse only. Thus, any sold privately in the country must have been got dishonestly, except scattered pieces which were not unfrequently found in the beds of the streams, washed down by the floods. Great care was taken to guard the mine. A house was built over the entrance and guards slept there with fire arms. When the ore was taken to London in the six horse waggon then used by carriers, half a dozen men, armed with blunderbusses, slept in the warehouse with the precious load, and guarded it on its way as far as Kendal. The present worthy steward of the mine is the fourth of the name who has held the office with great reputation for integrity and ability. His great grandfather Thomas Dixon, came from Langdale 150 years ago, and his descendants have continued in the office till the present time. The mine is now being re-opened, and it is hoped that it will be a profitable under-

taking for all concerned. This is the only plumbago which can be made into pencils to stand a point in its natural state, and is the purest and best in the world.

It has often been stated that Castle Crag was formerly a Roman Station. There is no trace of masonry, nor have any Roman weapons or coins been found upon the hill. The name of Borrowdale has been a puzzle. The most recent suggestion seems to commend itself as a natural explanation. It was common to call all strong places castles, where no artificial defence in the way of masonry was erected. Thus we have Castle Rock in St. John's, Rea Castle on the left of the pass to Watendlath, Castle Howe near Peile Wyke, and many others. So we have Castle Crag, in Borrowdale, which has been a place of defence during the incursions of the Scots, when the moss troopers made a short way into Lancashire. Coming over Binsa from Carlisle it was a near cut through the Stake Pass. Castle Crag formed a natural place of offence and defence and relics of machinery for throwing stones upon any hostile array, are said to have been found. The term burgh is often used as synonymous with castle *e.g.* the borough walls, Workington, and accepting this idea, Boro'dale would simply be the burgh defended dale.

The ancient endowment of Borrowdale chapel was £3 5s. It received an augmentation by lot of £200 about the year 1744, and had again in 1752 and in 1762 a further augmentation of £200 in conjunction with £200 given by the Countess dowager Gower, which sums were laid out in lands in Crosthwaite and in Lancashire. Recently the parsonage was built by the liberality of Joseph and Abraham Fisher, Esqrs., of Seatoller.

In all parts of the lake country the lands are passing out of the hands of the ancient Yeomen. A new race is coming in, building villas and making a total change in the appearance of the country. If Gray the poet could revisit Grasmere, he would hardly recognise the place. Perhaps in the parish of Crosthwaite, and in Borrowdale especially, there has been less change than elsewhere. The lands being freehold their owners have been able to leave them unencumbered to their children, which they could hardly have

done if they had been subject to arbitrary fines on the death of the Lord and the change of tenant. Long may the Yeomen hold their own! The Birketts of Rosthwaite can trace their property to have been 400 years in the family, and in all probability it has been so for double that length of time. The Fishers of Seatoller, the Youdales, the Jopsons and the Braithwaites, are of equal antiquity. The Wilsons have been at Watendlath more than 300 years. The Threlkelds came from Patterdale 150 years ago. There were 37 tenements in all enfranchised and bought free by the great deed of Borrowdale, and almost all the names exist, and many of them still own the same property. The tenements at Seathwaite were six in number, owned by Lamplugh, two Braithwaites, John Jopson, Nicholas Dickenson, and Thomas Birkhed. At Seatoller there were eight tenements belonging to two Fishers, two Braithwaites, two Birketts, a Jopson, and a Vickers.

Although I have said that there are no remains of Roman roads or masonry, yet there can be little doubt that the Romans crossed from one station to another by the mountain passes, where for temporary purposes they seem to have laid down blocks of unhewn stone to make the road passable. The nearest stations of the Romans were at Whitbarrow, at Caermot, at Papcastle, and at Ambleside. Their base of operations was never from the crown of a hill, but on a gentle slope commanding a view of the adjacent country. In the earliest times, however, hostile tribes met in deadly warfare, and these mountains and valleys have witnessed battles when the weapons were Celtic hammer heads, arrows made of stone, and similar missiles. No doubt the hardy mountaineers made good their defence on many occasions against invaders, from the natural places of defence which they could select as occasion required.

Although we see nothing recorded in the histories of the civil wars respecting the state of this neighbourhood, yet there are to be found from time to time glimpses of the turmoil having reached this parish. Sir Wilfred Lawson, of Isel, was a strong parliamentarian, and he with Cromwell's Ironsides plundered Rydal Hall, and his followers even tore up the flooring there, in search of treasure. His arsenal was on St. Herbert's Island; there he stored munitions of war and probably from

thence he started, taking Lord's Island on his way, and passed through Borrowdale over the Stake Pass to Langdale and Rydal. Sir Edward Radcliffe was residing on the Island in 1641, and for some time after. He mentions the fact in his will. It is probable that his house on the Island was battered down at this time, for there is no record of any one living in the house thereafter, and in 1750 there was a tree growing in the ruins of very large size, which was cut down with the rest of the timber on the forfeited Derwentwater Estate. Very likely the escape of the Lady of the house up Lady's Rake took place at this time, for a tradition so strong could not have arisen without some foundation in fact.

Borrowdale and Watendlath contributed trained bands forming, no doubt, part of the troop which Sir Edward Radcliffe raised for the service of the King, and probably for his own defence. At this period the smelting mills at Brigham, on the Greta, were destroyed by the rebels.

I have alluded to the Yeomen of Borrowdale as a class whose independence and energy are conspicuous whenever they emerge into the busy world. It was a Birkett who set on foot the first Banker's Clearing House, for which he was rewarded by a pension by the London private Bankers, who at first kept the establishment entirely to themselves, but it is now extended to Joint Stock Banks, and there is one in London for country Bankers also. This principle has been adopted by the Railways in their gigantic clearing house system.

Mr. Isaac Fisher, who died at the comparatively early age of forty five, was an instance of great ability and energy in business transactions, and he would no doubt, like his friend Sir Richard Birnie, have risen to eminence in London had he lived longer. As a representative man the Borrowdale Statesmen never had a worthier than the late Abraham Fisher, Esq., of Seatoller. Living among his own people, thoroughly understanding and appreciating his neighbours, he exercised an influence, social, moral, and religious, which was felt during his life and will be remembered for many years to come. He was the last of the Fishers of Seatoller, and no nobler man could be found to be the last representative of his family and name in Borrowdale.

PERSONAL NAMES.

By Peter Harrison, (Keswick.)

I purpose in this paper on "Personal Names," to take a passing glance at their origin and significance, and—in order to relieve the dryness of the subject—to add such little bits of history or anecdote as I have met with in connection with some of these names.

I use the term "Personal Names" *i.e.* the names of persons or individuals, in contradistinction to the term "Local Names," or the names of places. Nomenclature may be defined either as the science of name-giving, or as that science which investigates the principles upon which names are given, and forms a branch of what is termed *Philology*, which latter term, as understood at the present day, is a very large and a very wide subject indeed, embracing as it does the whole science of language or speech, but which fortunately it is not necessary to my present purpose to enter into upon this occasion. Indeed, if you consider for a moment how multitudinous is the variety of names found in the Directory of one of our large towns or cities, or even in a single copy of one of our Daily Papers, *e.g.* the "Times" or "Telegraph," and if you still further consider that every one of these different names has a history and significance of its own—although we may not always be able to get at the correct interpretation—you will readily understand that the subject I have taken in hand is a very large one of itself: so large, in fact, that it would be altogether impossible to do full justice to it in the compass of a single paper. I am therefore under the necessity of confining myself chiefly to a consideration of one branch of the subject, viz., to that of *Surnames*, which will however necessitate occasional references to *Prenomens*, or what we understand by baptismal or Christian names.

Surnames, or names superadded, it may be useful to notice at the outset, have at all times and in all nations been but a kind of second, or after-growth, springing up not from *caprice* but from necessity. In the more primitive stages of society where population is but scanty and thinly scattered a single appellative seems to be all that is required for particularising one person from another. Without referring to the custom prevailing among the native tribes of America or Australia at the present day, we see this well exemplified in Biblical nomenclature. In that oldest of all Books, the Book of Genesis, we find the single names, Adam, Eve, Cain, Abel, Seth, Adah, Zillah, Noah, Abraham, Isaac, Jacob, Joseph, &c. At a somewhat later period in the history of the Israelites a second name began to be applied, at least in some few instances, as Joshua the Son of Nun, Caleb the son of Jephunneh and Jair the Son of Manasseh. It must be remembered that at this time the Israelites were living in a small corner of Egypt and had greatly multiplied in numbers, so that it is probable these second names were given for the purpose of distinguishing those to whom they were applied from others of the same name. They are probably the earliest surnames to be met with, and they are examples of what are termed *patronymics*, formed precisely in the same way and from the same cause that hundreds of our present surnames were formed some six or seven centuries ago, *e.g.* John*son*, the son of John ; William*son* ; Robin*son* ; or the Norman *Fitz* Herbert, the son of Herbert, or Herbert*son* ; or the Scotch *Mac*.Donald, Donald*son*, or the son of Donald ; or the Welsh Ap Thomas the son of Thomas, or Thom*son* ; or the Manx Killip, *i.e.* the son of Phillip or Phillip*son*. In still later times when they had become still more numerous and settled down in cities, the Jewish people in addition to these *patronymics* which they still retained, as seen in such names as *Bar*jonas, *i.e.* the son of Jonas, had recourse to other kinds of surnames, such as Simon the *Zealot*, which is of the descriptive class, or Simon of Cyrene and Judas of Galilee which are *local*, *i.e.* denote either the place of birth or residence.

Again, if we turn to the oldest of extant Heathen writings, *e.g.* Homer's Iliad, we find the characters there designated by single names, as Achilles, Ajax, Hector, Priam, &c., with a few patronymics as Atrides,

Pelides, and a few descriptive or epithetic names generally applied to the Gods and Goddesses of the Greek Mythology. The same need of surnames was undoubtedly felt by the Latin races as they settled down in masses and progressed in civilization. In the Augustan age the Roman citizen generally bore a threefold name. The first, denoted the *prenomen*, corresponding to our baptismal name; the second, was the *clan* or family name; the third answered to our modern *surname*, and was often bestowed in the first place in much the same way as many of our surnames were given, viz., from some cause or quality affecting the owner; thus, in Titus Manlius Torquatus, Titus is the *prenomen*, Manlius the *clan* name, and *Torquatus* the *surname*—which signifies, "One provided with a torquis" and was acquired by Titus Manlius wearing the necklace of a Gaul whom he had slain in battle. At this time too the Greeks were using double and in some cases threefold names, but their system of nomenclature was neither so precise nor so complete as that of the Romans.

Let us now turn to our own country and see what was the custom prevailing here. The earliest inhabitants of the British Islands of whom we have any written record were undoubtedly of the Celtic race. They must have reached Britain long anterior to the beginning of the Christian Era, probably not less than 1,000 years. Their descendants, it may be remarked in passing, still exist in the north of Scotland, in Wales, Ireland and the Isle of Man. Until within a comparatively recent period the Celtic language continued to be a spoken language only, and therefore we are furnished with but a scanty stock of Celtic names, those of Cassivellaunus, Caractacus, Cartismundua, Boadicea, (all in the Latinized form, remember) Vortigern, Vortimer, the legendary Arthur, and our own better authenticated *Dunmail* "last King of rocky Cumberland," are familiar to all readers of history, and in them we see again a people using one appellative only. The hordes of Jutes, Angles, Frisians, and Saxons, now comprehended under the generic term, Anglo-Saxon, who continued to pour upon our shores during part of the 5th and throughout the 6th centuries, used single names only by which to distinguish themselves one from another, though frequently individuals amongst them acquired a

second name, generally from some quality of mind or body possessed by the owner, as, Ethelred Mucel (the term Muckle or Mickle, *great*, still lingers among us colloquially) *i.e.* Ethelred the great—huge of bulk or proportion; Hewald Black and Hewald White, mentioned by Bede, who tells us they were so called from the colour of the hair. Most of you, too, will be familiar with the historical epithets of *Unready*, *Harefoot*, *Harfagres*, *i.e. Fair Locks*, modern *Fairfax*, Ironsides &c. But I must ask you to bear in mind that in no instance did these acquired names become hereditary. They invariably died with their possessors, though some centuries later when names did become hereditary, epithets of similar import were bestowed which took root and still abide among us as our Blacks, Whites, Grays, Sharps, Lightfoots, Heavisides, are at hand to testify. Since many of the Saxon single names are in themselves very expressive, generally betokening some mental or physical characteristic of the individual, but more especially because a large number of them have come down to us and form part of our present stock of names, both prenominal and surnominal, I think I cannot do better than turn aside for a moment and select a few for special notice. Fortunately for our purpose, long before the Saxon rule came to an end in England, the various spoken dialects of the early invaders had become blended into one language and had passed from a mere spoken speech into a written tongue, of which there is a comparatively large stock of its literature still extant, out of which Dictionaries and Grammars have been formed.

Instead of forming half-guesses, therefore, or of taking upon trust the half-guesses of others, we can go to the fountain's source and satisfy ourselves. The following may be set down as some of the leading Saxon roots of most frequent use in the composition of Saxon names:—God, signifying Deity, or Good, which was synonymous with Deity while the Saxons were in a state of Heathenism; *Os* a hero, also signifying Deity; *Thor*, the Teutonic Jupiter, or Father of Heaven; *Wulf* and *Wylf*—a Wolf; *Orm*, a serpent or *worm*; *Win*, *Hild* and *Guth*, all signifying, battle, war or strife; *Sig*, a conquest or victory; *Helm*, a helmet; *Bald*, bold; *Wald*, power or dominion; *Rice*, mighty, (compare our modern term *rich*); *Ethel*, noble; Eàd or *Eadig*, blessed or prosperous;

Wyne, pleasant, or as a noun, Joy or Pleasure; *Bert*, bright; *Ulf*, help; Red or Roed (hence our modern *read*) used in the composition of names both as a prefix and a postfix and signifying *speech*, *counsel*, *prudence* or *sagacity*; and lastly *Frith*, peace. Hence such modern names as Goodwin, Godfrey, Goderick; Oswald, a heroic ruler; Osmond, protected by the Gods; Oscar, Osbert, Oswy and Osric. From *Orm*, a serpent, which was a common personal name among the Northmen, is derived our local name "Ormathwaite," which in our days has given a title to a peer of the realm, and *Ormerod*, which is the exact synonym of Ormathwaite, both signifying Orme's Clearing. Then we have *Hildebrand* which signifies the torch of war, as *Guthred* does sagacious in war; *Guthlac* is the modern Goodlake; *Baldwin*, bold in battle; *Ethelred*, noble in council; and *Ethelwolf*, the noble wolf; *Egbert*, bright eyed; *Edwin*, gainer of prosperity; *Edward*, guardian of happiness. It would be easy to extend this list, but half a dozen Saxon feminine names must suffice. Alfred the Great, we learn, married the daughter of a Mercian noble; she bore the name of Ethelswitha, which signifies, *noble in the highest degree*; then we have *Winnefred*, pleasant or persuasive or perhaps, winning in speech (Cf. our old English word, *winsome*); *Mildred*, mild or gentle of speech; *Bertha*, the bright maiden; *Ethelinda*, the noble maiden; *Edith*, the happy, or blessed or prosperous maiden.

With the advent of the Norman rule was ushered in a host of new names which for a time eclipsed the Saxon, as the historical records of Rolls of Courts of the period abundantly testify; indeed it seemed as if not merely the Saxon names but the Saxon tongue itself was to become extinct. We all know how under the stern savage rule of the early Norman Sovereigns the Norman language was constituted the language of the Court, the Church, the Baronial Hall, the Courts of Law and Justice and the Public Schools of the Kingdom; and most of us know I suppose, how, after a struggle for the mastery between the two—the one the language of the rich, the powerful, and the noble, the other the language of the common people—for more than 200 years, the down-trodden and despised Saxon tongue finally re-asserted its sway, and how it now forms the staple of modern English as spoken in the walks of everyday life,

in the busy mart, or on our highways, or by the quiet fireside, or as we have it enshrined for generations yet to come of English-speaking men and women in the grand old Version of our authorised Bible, or as we read it in the pages of Chaucer and Wycliffe, in the dramas of Shakespere or the pages of Bunyan, or in the works of Dickens and Tennyson. All this is familiar to every student of English History and therefore I need not dwell upon it here, yet,—though, somewhat foreign to my immediate subject—I cannot resist reading to you the words of an eloquent modern writer upon this conflict between the two languages "Thus we see," he says, "that Conquests cannot exterminate a language, nor drive it from its native soil. The Normans with all their power and strength, lords of the land, masters of the people and with every advantage on their side, could not destroy a highly cultivated ancient and national tongue like the Saxon. * * It rose against them and conquered them in its turn. * * They could as Conquerors seat their Norman French upon the throne and judge's bench—at the dais of the noble and in the refectory of the monk, but they found the door of the manor house and the cottage jealously guarded. * * The Norman French was neither carried to all parts of the Kingdom, because of the comparatively small number of invaders, nor supported by the aid of superiority. The Anglo-Saxon on the other hand had been carefully guarded and preserved by the people, it had never lost its hold upon their affections. Persecution and the neccessity of concealment had made it all the dearer to the suffering race. It now made its way, slowly and imperceptibly, but with unerring and unceasing perseverance, from rank to rank, until it finally reached the very court from which it had been so ignominiously driven, and seated itself once more upon the throne of England."

Amongst the personal names due to the Norman Conquest the most prominent are William, Robert, Henry, Richard, Roger, Hugh, Reginald, Roland, Oliver, Miles and John. And from these were afterwards formed a vast number of patronymic surnames. But in addition to the patronymics formed by prefixing Fitz, the Normans introduced another class of names which soon began to assume an hereditary character viz., *Local* Names, or names derived from place of residence. No sooner did the Conqueror

find himself securely seated on the throne than he rigorously established the Feudal System of the Continent by parcelling the land among his followers, and these Norman Feudatories for the sake of distinction were generally known by the name of the place whence they had set forth in their Norman home. Hence are due such names as Granville, Boville, Neville, Tankerville, Colville, Villiers, Beaumont, Harcourt, &c. For several generations these surnames were prefixed by the preposition de, *of*, or *from*, as Hugh De Granville, *i.e.* Hugh of the great house or town, and so on, but in course of time these prefixes were either cast aside or became incorporated, as Delamere, Delisle, Defontaine, Deville, &c. Dilston Castle, the Northumbrian seat of the last Earl of Derwentwater, it may be noticed in passing, is a contracted form of this latter name, *Deville* and the suffix *ton* an enclosure—*i.e.* Deville's ton. The time was now come when a second name or surname was becoming absolutely necessary throughout society generally for distinction's sake. We have seen that for some centuries preceding the Conquest the custom had been in use in particular cases, but in every instance such surnames which were almost in all cases of the *descriptive* class, passed away with the lives of the owners. They did not become hereditary, *i.e.* they were not handed down from one generation to another. Now, however, a change was to take place. "Slowly at first, and silently and unpremeditatedly but nevertheless surely,"—I am quoting the words of a writer upon the subject, —"it came to pass that the name by which one man was distinguished from another became part and parcel of his property and passed with his other property to his direct descendants." It is impossible to fix upon any particular epoch or indeed any particular reign when surnames first became hereditary, but speaking generally it may be said that the custom arose in the latter part of the 11th century or early in the 12th, and continued until the close of the 14th, *i.e.* the time of Chaucer, before our present nomenclature was completed. The Normans undoubtedly gave the first impulse to this new fashion by adopting as a distinguishing name the residential or Place-name. How long the custom was in finding its way into our own then remote part of England we have no means of ascertaining but that it did find its way here we have undoubted proof in the

Registers of our Parish Church—more than 300 years ago—and how much farther back we cannot tell for unfortunately our Registers go no farther back. More than 300 years ago, there were families residing in the parish bearing the still familiar names of Thwaite; Braithwaite (*i.e.* Broadthwaite,) Thornthwaite, Dowthwaite, (I take this to be dark or gloomy thwaite), Birkhead (now Birkett,) Borrowdale, Threlkeld, Yewdale (which I believe was the Ancient name of Borrowdale,) Howe, Gillbanks, Banks, Gasgarth, Brownrigg and Leathes, all of which names are still living and I trust will long continue to live and thrive in our midst. But these Registers also furnish us with some interesting names which are now extinct, or extinct as far as I can learn to the contrary. We find the name, Smaithwaite (which I think means Small Thwaite) Langstrath (we find this family settled at Watendlath from 1565 till 1612,) Cowdale, which in these latter times has become corrupted into Coledale, and in 1607 the name of one Thomas Buttermere appears. The surname, Derwentwater, has long been extinct, but the personal name Wastwater only died out so lately as in the present century, for in our Parish Churchyard I find a tombstone inscribed to the Memory of Robert Westwater (Wastwater) who died in 1814 and of Isabella his wife, 1816; our venerable sexton—and no doubt others still living in Keswick—remember the old couple.

It would be impossible in the limited time at my disposal to do more than take a hasty survey of this part of my subject, but as to leave it here would be to leave it in a very improper state, I will furnish you with a list of Saxon roots of Place-names which occur most frequently in the composition of Modern Local Surnames, and then those who feel sufficient interest or curiosity in the matter may interpret for themselves:—

The *Thwaite* was a forest clearing, or land enclosed and cleared of timber. The *Royd* or *Rod* was the ridded land, or clearing in the thickly wooded districts, compare Acroyd (oak), Holroyd (holly), Huntroyd, the clearing for the purposes of the chase, &c.

Greave, *Grove* and *Grave*, a woodland avenue cut or graved out of the forest—compare our locally common names of Grave, Grove and

Greave, also such compounds as Gravesend, Hargraves (hare), Congreve (Coney or rabbit,) &c.

The *Hirst* is a term synonymous with wood—hence we have Lyndhurst, Brockhurst, &c.

The *Holt* was less in size than the Hirst, being merely a small thicket or coppice. To it are owing such names as Oakshot, Bagshot, Aldershot, Cockshot, all of which are softened in sound by the elision of the letter l.

Shaw, a small woody shade, a covert forming shelter for game and the wilder animals. Bagshaw signifies the Badger's shaw. We have also Hindshaw, Ramshaw, Earnshaw (Earn, Eagle), Openshaw, Broadshaw and Shaw.

The *Den* or *Deane*, a sunken and woody dale affording food and shelter to cattle—Brogden *i.e.* the Brock or Badgers deane, Ramsden, Hareden, Dearden, Oxenden, Swinden, Ogden, *i.e.* Hog's den.

The *Ley* was pasture land undisturbed by the plough, and afforded pasturage to all manner of domesticated animals and some of the wilder kinds, if we may trust such surnames as Hartley, Oxley, Cowley, Horsley, Rowley, Buckley, Shipley (sheep), Hindley and *Kin*ley,—which last is the *Kine ley* or cow-pasture and which in its turn by the addition of the suffix, *side* becomes *Kinleyside*—then we have Stanley (Stony), Ashley, Elmsley, Oakley, Lindley, Berkley, and Ridley—a name made illustrious in our annals by the old stouthearted martyr, Bishop Ridley, who sprang from a well known Northumberland family of that name. This list might be greatly extended but enough has been said to show what a fertile source of surnames these Local names have been. The roots, Holm, Knoll, Lynch, Slade, Frith, Kay, Hill, Cliff, Clough, Cop, Cope, Cob, Down, Dun, Ton, Ham, Combe, Moor, More, Howe, Law, Shore, Over, Hatch, Gore, Gate, Gale, Cross, Rood, Stead, Mead, Croft, Garth, Yard, Hay, Worth, Grange, Field, Barn, Leath, Booth, Bower, Scale, Bold, Thorpe, and Borough have all helped to swell the list of proper names.

But numerous as these roots are they were not sufficient to supply surnames to each separate family. To make a homely illustration of my meaning—all the families living at Crosthwaite, or Thornthwaite, or

Threlkeld, or Borrowdale, could not take their names from their place of residence, otherwise the quality of distinction would to a great extent have been lost. Therefore other modes were also adopted. The best known of these was the *patronymic*, a class at which I have already glanced. Thus where the head of a family bore the name of John his sons became known as John's sons—so of Robert or William, and eventually these individuals became Johnsons, Robertsons or Williamsons; and so on through the whole list of baptismal names in vogue at the time surnames were forming. Again, these patronymics were much increased by the custom which prevailed then as now of using contracted or corrupt forms of baptismal names. Thus we have *Wil*son, *Jack*son, *Dick*son, *Hick*son, (Hikke was a corruption of Isaac), *Wat*son (Wat, for Walter), *Daw*son (Daw, a corruption of David,) &c., &c. And, again, the list was still further increased by the use of pet names, or names of endearment, which were then given, as now, in the nursery and playground. Thus our Charles becomes Charlie, William, Willie, John is known as Johnnie, Edward is familiarly styled Teddy, and Robert, Bobby. Our diminutives you will see are *ie* and *ley* but they were unknown in England 500 years ago or assuredly we should have had, odd as they may seem, such corresponding surnames as, Johnnieson, Willieson, Teddyson, and Bobbison. The pet forms in use at the time were of quite a different form and they must have been in very common use: the principal terminations were *Kin*, and *Cock*, both of Saxon orgin, and the Norman diminutives *ot* or *et* and *on* or *en*. *Kin* has its living representative in the German *Chen*, as Mädchen, a young or little maiden and still exists in our lambkin, pipkin, mannikin &c. To it we owe such names as Tomkin, Jenkin, Wilkin, Atkin, Simpkin and their compounds Jenkinson, equivalent to Johnson, Atkinson, *i.e.* Adamson &c. The diminutive Cock or Cox still lives in our nursery literature in the forms of Cock-robin, Cock-boat, Cock-horse; we owe to it such names as Cox, Cowx, Wilcox &c., &c. The Norman *on* or *en* played no small part in the formation of our surnames, Robert became Robin; Nicol was transposed into Colin; Richard was familiarly known to his schoolmates as Diccon; Pierre became Perrin, and Mary Marion, and in this manner sprang up such surnames as Robinson,

Collinson, Dickinson, and Dickens. *Ot* or *et* exists still in such words as pŏcket, a little poke or bag; ballot, a little ball; chariot, target, hatchet, and latchet. To it we are indebted for such names as Emmet, Elliot, Tillotson, Hewetson, and many others.

Before finally leaving this part of my subject I will refer briefly to the modes in which patronymic surnames were formed severally in Scotland, Ireland, Isle of Man, and Wales. The Norman patronymic we have already seen was formed by prefixing *Fitz*, which is a corruption, or perhaps more correctly speaking, a modernised form of Latin, filius, a son, and thus Fitzwilliam is identical with Williamson. In Scotland the terms Mac and Vich supplied the place of the Saxon, Son, or the Norman Fitz; thus Mac Donald is Donalds' son or Donaldson. The Manx, whose language is very closely allied to that of the Scottish Highlanders, formerly used this term *Mac* but curiously enough in most Manx names of the present day the letters Ma have been cast off and the C has become incorporated with the baptismal name, thus forming a list of surnames whose initial letters are represented by K or C hard and In. These surnames as seen on the sign-boards of Douglas soon attract the notice of the visitor to the Isle of Man and at first sight are puzzling even to the curious in name-lore. I found in an old note-book the following list which I suppose must have been made in order partly to while away the time of my stay. *Kill*ip, *Kis*sack, *Kew*win, *Kaig*han, *Ker*ruish, Kinrade, Kewley, Kermode, Kineale, Keig, Callow, Clucas, Clague, Costeen, Kneen, Craine, Creppin, Cubbin, Curphey, Callister, Gillow, Quaye, Quayle, Quark, Quilleash, Quaggin, Quiggin, Quill, and a few names compounded with the prefix Mal, a male, and Gil—Scotch, Gillie, a servant, *e.g.* Malyvoirrey, Malyvartin, Mollyree, Mollyruig, Malychreest, Gilchreest &c. Time will not allow me to do more than interpret a few of these. Kissack is Mac Isaac or Isaac's son, Callister is Alexander's son, Killip is Phillipson, Kewin is MacEoin or Johnson just as Costean is Stephenson and Clucas Luke's son, Quark is Mac Pharick, *i.e.* Patrickson, Quayle is Mac Fayle or the son of Paul, Kermode is the son of Dermot, Quilliam is equivalent to Williamson, Quill is our common name Wilson, and Kneal, is the son of Niel, as is also a name which has lately come into undue prominence,

Kenealy. Malyvoirrey represents Mary's son, anglice Morrison; Mollyruig is our Ritson, *i.e.* Redson, the Norman synonym of which is Fitzroy; Mollyvriddy is Bridget's son, and Malyvartin Martin's son, while Christopherson finds its name synonym in Malychreest.

The Irish, whose language again is very closely akin to those of both the Highland Scotch and the Manx, use the same prefix *Mac* by which to form patronymics, but they much more frequently supplant the *Mac* by prefixing the letter O.' Need I cite such well known names as O'Connel, O'Brien, O'Rourke, O'Sullivan, O'Donoghue? Now I must confess this prefix O' puzzled me a good deal some times, but searching through the pages of a Celtic dictionary one day for quite a different purpose I accidentally stumbled upon the following explanation. "O' is a prefix signifying, *of* or *from*, and added to proper names signifies the oldest branch of a family, for," adds the lexicographer "the Erse, *i.e.* the Highlanders, use Mac for a descendant or son but the Irish use O, as in O'Neil, considering this appellation as being the further removed." So it appears that family pride—pride of name or descent is at the bottom of it all. The more modest Highlander or Manxman is content to style himself the *son* of his immediate ancestor but the Irishman by the use of O,' which is less definite than Mac or Son, wishes to show that his descent dates farther back than at least one generation. In the same spirit the Spaniard who can claim the title of Hidalgo to his name is proud to show on all occasions that he is the son of some one and he looks down upon those families who have not acquired this title as a parcel of nobodies.

We now turn to Welsh names, but I must be very brief on this head. Like the Normans, Scotch, Irish, and Manx, their patronymics are formed by a prefix, viz. *Ap*, signifying also, "*The Son of.*" In former days the Welshman was proud to show he had an ancestry of more than one, or two, or even three descents and for this purpose had recourse to repeating the *Ap* instead of using the indefinite O, of the Irishman. This custom is playfully satirized in the Play of Sir John Oldcastle (1660.)

SCENE—A Court of Justice.

Judge.—What bail? What sureties?

Davy.—Her Cozen, Ap Rice, Ap Evan, Ap Morrice, Ap Morgan, Ap Llewellyn, Ap Meredith, Ap Griffin, Ap Davis, Ap Owen, Ap Thenkin Jones.

Judge.—Two of the most efficient are enow.

Sheriff.—And please your honour they are all but *one.*

As we have seen in the case of the Manx *Mac*, the Welsh *Ap* became in process of time abbreviated, indeed we may say almost lost, by casting off the initial *a* and incorporating the *p* in the personal name, and thus we have the common Welsh surnames of Probert, Probyn, Prichard, Prodgers, Penry, Penrice, Parry, Preece, Prosser, Pugh, Powell, Pumphrey, Bevan, Bowen, Bethell—of course Probert is Ap Robert or Robertson, Probyn Robinson, Pritchard Richardson, Prodgers Rogerson, Parry is Harrison, and Penry is the son of Henry, and so on through the whole list of names of this class.

Of Cornish names, too, want of time forbids me to speak; many of them will be readily detected by remembering the old distich :—

"In *Tre*, Pol, and Pen,
You may know the Cornish men"

The next class of names I have to deal with are of a different kind altogether. There is nothing more natural than that some individual should have been known among his neighbours by the name of the occupation he followed, and it is not too much to say that in our modern directories every kind of occupation known to our forefathers of five or six centuries ago has its representative surname—we have Butcher and Bewsher, Baker and its feminines Bagster and Baxter, Webb with its feminines Webster and Weaver, Dyer, Fuller, Tucker, and Walker which last is derived from any superior pedestrianic powers, as some might suppose, but to a veritable and highly useful occupation, in the days of home-spinning and home manufacturing, viz.: that of the Walker or Treader of the cloth. Wickliffe's Version of the Transfiguration on the Mount renders the passage thus "His clothes became shining so as no *fullere* or *Walker* of *Cloth* may make white upon earth." Our Sharman, Sherman, and Shearman were shearers or croppers of the manufactured Cloth—then we

have Tanner, Skinner, Wooler, Currier, Fellmonger, Glover, and Barker (*i.e.* he who attended to the preparation of the bark used in the tanning of leather); the Tailor, Draper, Mercer and Flaxman are each represented in our nomenclature; so are the Waller, Slater, Thatcher, Joiner, Carpenter, Wright, Sawyer, Painter, Nailer, and if we turn to the occupations of rural life we find represented in our directories and newspapers of the present day, the Squire, Yeoman, Farmer, Steward, and Bailiff, the Wheeler and Wheelwright, Carter and Cartwright, and Wainwright, *i.e.* Wagonwright. If we bear in mind that the more menial occupations were performed by the serfs who were still bought and sold with the glebe, we need be at no loss to understand how it came to pass that each separate duty of the farm had a particular individual assigned to it. There was the Herd, Shepherd, Cowherd (Coward), Calvert (Calfherd), Stoddart (Stot herd), Coulthard (Colt herd), Cowman, Horsman, Hayward (*Hay*, hedge and *ward*, keeper), Hogward (modern Hogarth) and Woodward. We may readily understand, too, how in a district like our own the surname Fisher came to be so widely spread—probably in common with many of those just mentioned, it had several distinct centres of origin—the same may be said of such names as Hunter and Todhunter (so late as the time of Shakspeare the fox was known as the Tod). It would be tedious to run through the whole list, therefore I shall close this part of the subject with the commonest of all surnames, that of Smith. Between the years 1838 and 1854, *i.e.* 17 years, there were registered in England as born, married or died no less than 286,307 people of the name of '*Smith.*' In medieval England it must be remembered that the Smith was an important personage in rural life—our old literature is full of allusions to him. No village could dispense with his services. To worker in iron he added the profession of Cattle Doctor, and upon a pinch could exercise the art of phlebotomy upon his neighbour. His smithy was then as now a centre of village gossip and village politics. You remember how well the Smith of our days has been drawn by one of the sweetest of living poets:—

> "Behind the spreading chestnut tree
> The village smithy stands,
> The Smith, a mighty man is he

With large and sinewy hands,
And the muscles of his brawny arms
Are strong as iron bands.

His hair is crisp and black and long;
His face is like the tan,
His brow is wet with honest sweat,
He earns whate'er he can,
And looks the whole world in the face,
For he owes not any man.

* * * * *

And children coming home from school
Look in at the open door;
They love to see the flaming forge
And hear the bellows roar,
And catch the burning sparks that fly
Like chaff from a threshing floor."

I am afraid I have left myself but little time to notice the two remaining classes of Surnames, viz., those derived from office and those which were bestowed in the first place as Nicknames and afterwards became hereditary. I must therefore hurry over this part of my subject. Of the former many of them are due to the mock ceremonies, outdoor pageantries and rural games of the middle ages. Of such are King, Pope and Pape, Cardinal, Bishop, Abbot, Duke, Lord, Barron, Monk—others are due to the offices their owners held, as Vicars, Parson, Priestman, Chaplin, Clerk, Crozier, *i.e.* he who bore the pastoral staff, Latimer, *i.e.* Latiner or teacher of Latin. We have also represeuted, the Mayor, Sheriff, Reeve, Burgess, Beadle, Clerk, and Wake or Watchman, *i.e.* the modern Policeman—and Constable, Forester, Parker, Woodruffe, *i.e.* Woodreeve, Fowler, Falconer, Messenger, Spencer, *i.e.* he who had charge of the buttery or spence, as well as Butler, *i.e.* Bottler, he who had charge of the bottles, an important office in the days of our hard-drinking forefathers.

The Surnames owing their origin to soubriquets or nicknames are so numerous that I almost shrink from touching upon them here. It is a curious but well known fact that in the history of our religious sects as well as of our political parties, the names by which they are now best known are those bestowed upon them by the outside world, not the

names which the founders wished to give them, and they have generally been bestowed upon them in an opprobrious sense. For instance such terms as Quaker, Methodist, Ranter, and Shaker, or Whig, Tory, or Radical—and thus it has been with hundreds of our modern Surnames. One man was distinguished from his fellows by some striking physical or external peculiarity, such as the colour of his hair, his stature, shape of body or limb, his prowess, age or condition. Another was known by some mental or moral peculiarity or endowment. Thus we find in our directories the namas Long, Short, Longman, Little, Big, Grant (*i.e.* Grand, Great) High, Lowe, Greathead, Whitehead, Cruikshank, Sheepshank, Armstrong, Strongitharm, Strong, Legge, Foote, Swift, Slow, Sly, and Golightly. Nearly all the colours are represented, Black, White, Gray, Brown, Dun, Scarlet, Red (Reed), Blond, Yellow, and Fallows, *i.e.* the pale yellow colour of our fallow fields, and also the colour of the fallow-deer; then we have Whitelock, Blacklock, Blackman, Whitman, Redman. So of the mental or moral peculiarities, thus there occur Wiseman, Goodfellow, Merry, Gay, Blythe, Joyce, Makepeace, Trueman, Hardy, Smart, Quick, Sharp, Freake (*i.e.* fresh), Bold, Doughty, Champion, Careless, Jolly, Merryweather; Playfair is Playfellow—from old English fére a fellow or Comrade, Pennyfather was an opprobrious term for miser. The insect world, the beast world, the fish-world and the bird-world are all represented in our directories, and the same may be said of the vegetable world, but I must close here. If I have succeeded in awakening among you an interest in a subject usually considered dry and uninviting but which in reality throws a good deal of light upon the social customs, modes of thought, manners and occupations of our forefathers obtainable from no other source, the chief object I had in view in setting out is attained.

ON THE SPECTROSCOPE.

By G. J. Snelus, Assoc. R.S.M. (Workington).

Delivered to the Workington Society (April 26th, 1876), and before the Cumberland Association (May 1st, 1876,) at Whitehaven.

The invention of the Spectroscope may fairly be considered one of the most important triumphs of modern science.

In explaining its construction and use it will be advisable that I remind you briefly of the nature of light. Modern Physicists hold that light is the result of vibrations of the particles of an extremely attenuated medium, termed the luminiferous ether, which is supposed to permeate all space. Just as *sound* is the result of motion imparted to the air, which motion is propagated in the form of waves, the size of the wave determining the pitch of the sound; so light is the result of wave motion among the particles of the luminiferous ether, different sized waves producing differently coloured lights. But while the motion of the air producing sound is comparatively slow, the highest musical sound that the ear is capable of detecting being produced by 38,000 vibrations per second, and the lowest by 16, the smallest number of vibrations capable of affecting the eye and producing a red ray is about 451 millions of millions per second and the length of the wave is only $\frac{1}{37,000}$ th part of an inch. As the waves decrease in length and increase in velocity the eye interprets the result as orange, yellow, green, blue, and violet, respectively, till we get up to 789 millions of millions per second with wave lengths of $\frac{1}{64,000}$ th the H line in the violet, which is the most rapid wave the eye can register under ordinary circumstances. White light is the result of vibrations of several degrees occuring together. When white light impinges upon different objects they stifle some rays and either reflect or transmit others. When white light falls perpendicularly upon colourless glass, if the two surfaces are parallel, the ray passes straight through, it is neither bent out of its course nor changed in any way, but if

the two surfaces meet at an angle and form a wedge or prism and the light is directed against one surface obliquely, a part of the light passes through the prism, but in doing so it is not only bent out of its course but it becomes analyzed, and those rays such as the blue, which are the result of shorter and quicker waves, are more bent or refracted than others, such as the red and yellow, produced by longer and slower vibrations. Newton discovered this fact and propounded it exactly 201 years ago in the form of the celebrated theorem that "lights which differ in colour differ also in their degree of refrangibility." His mode of proof was as follows.—Through a small hole in the shutter he allowed a ray of light to pass into a darkened room, forming a spot of white light upon the opposite wall. He then interposed a prism of glass so that the ray of light fell obliquely upon its surface and was delighted to find the spot of white light replaced by a band of most gorgeous colours.

Newton termed the band of light so obtained the spectrum. I cannot shew the spectrum of sun light, but I will endeavour to show you the spectrum of a white light, the electric light, which rivals that of the sun in intensity. You will observe that the spectrum is continuous, and the colours shade off gradually into one another. Newton saw no more than this when he examined sunlight, because he admitted his light through a round hole. But Wollaston on admitting the light through a narrow slit found that the spectrum was crossed by a number of very fine dark lines, and Fraunhofer carefully mapped and lettered these lines which have since borne his name. Kirchoff and Bunsen employed this plan for examining coloured flames, and instead of employing a dark room and shutter with a slit, constructed the instrument termed the spectroscope. I have here the instrument in one of its earliest forms. You will observe that it consists essentially of a triangular prism of glass, fixed firmly upon a table. Opposite one face of the prism there is a tube, at the end of which is an arrangement for admitting a ray of light through a very narrow slit. This ray of light strikes the face of the prism obliquely, and in passing through the glass it is both refracted and decomposed, and can be seen through the opposite face of the prism. In order to view the ray more accurately a telescope is placed opposite this face. Two fine cross

wires in the telescope give a fixed point, which can be brought upon any line in the spectrum so as to register its position.

In this instrument you will observe that there are two prisms side by side. The ray of light passes through both and is thus spread out into a much broader band; the number of prisms is sometimes increased to such an extent that the emergent ray crosses its original path. The prisms may also be so arranged that the ray of light passes out of the telescope in a direct line from its source. Such an instrument is termed a "direct vision" spectroscope and is very handy for general work, but is not suitable for very delicate research.

It had long been known that certain substances when burnt produced variously coloured flames. Thus I have here some of the red fire of the pyrotechnist and you will see what a splended crimson flame it produces. Fox Talbot examined this flame (among others) with the prism, and discovered that its spectrum was crossed by brilliantly coloured lines.

Soda salts produce a yellow line and Swann very nearly discovered the true cause, but the absolute discovery remained for Bunsen and Kirchoff. They found that all sodium salts gave this yellow line, and that no other substance that was perfectly free from sodium did give the same line; hence they rightly argued that the presence of this line in the spectrum was indicative of the presence of sodium in the flame. They were not long in generalizing upon this fact, and found that every elementary substance which could give rise to a flame in burning, produced a definite set of lines which always occured of the same colour, in the same position, and of the same strength; and they termed these lines the spectrum of the element. They carefully mapped all the lines produced by the then known elements and used these maps to discover the nature of unknown substances, just as the mariner uses his map to discover his whereabouts in approaching an unknown shore. Their work soon bore remarkable fruit, for in examining the residue from a German mineral water they saw some lines which were new to them, and immediately concluded that they had dropped across an unknown element. And so it turned out; for after patiently evaporating 44 tons of the Durkheim spring, they got 200 grains of salts, of what they found to be two new

metals, which they termed Caesium and Rubidium. Shortly afterwards our own countryman Mr. Crookes saw in his spectroscope, when examining the residue from burning pyrites, a beautiful green line that was new to him and this turned out to be produced by the salts of a metal till then unknown, but which he was not long in preparing by the cwt. He termed it Thallium. Indium is a fourth element discovered in the same way.

The following table will give you some idea of the delicacy of this mode of analysis and of the quantities which may easily be detected. 1. Sodium. $\frac{1}{3,000,000}$th part of a millegramme, or $\frac{1}{180,000,000}$th part of a grain. 2. Lithium. $\frac{1}{100,000}$th part of a millegramme, or $\frac{1}{6,000,000}$th part of a grain. 3. Strontium. $\frac{6}{100,000}$th of a millegramme, or $\frac{1}{1,000,000}$th of a grain. 4. Calcium. $\frac{6}{100,000}$th of a millegramme, or $\frac{1}{1,000,000}$th of a grain.

We will now pass to the examination of the sun by the spectroscope. I told you that the solar spectrum was crossed by a large number of very fine dark lines. It had long been known that one of these, the D line, corresponded in position with the bright yellow line produced by Sodium. Kirchoff and Bunsen discovered that other dark lines corresponded in position to the bright lines found in the spectrum of other elements and upon carefully comparing that of iron, which contains no less than 460 bright lines, they found that each one of these was matched by a dark line in the solar spectrum, and the conclusion was irresistibly forced upon them that these dark lines must be caused by iron existing in the sun. But why were the lines dark and not bright? They solved this question by observing that the sodium flame was opaque to the light which it itself emitted. Thus if we have a glowing substance producing this particular ray D and place before it a sodium flame we see a black patch in the place of the yellow flame. This is exactly the state of the case in the sun. The body of the sun, which is termed its "photosphere," contains certain glowing elements, and the vapour of these elements, at *a much higher temperature*, surrounds the photosphere; the particular rays emitted by the substances in the photosphere are absorbed by this vapour and instead of seeing a bright line we see a dark one. In the case of certain of the stars some of the lines are actually bright. The following bodies have in this way been detected in the sun :—

1. Sodium.	5. Iron.	9. Zinc.	13. Hydrogen.
2. Calcium.	6. Chromium.	10. Strontium.	14. Manganese.
3. Barium.	7. Nickel.	11. Cadmium.	15. Aluminium.
4. Magnesium.	8. Copper.	12. Cobalt.	16. Titanium.

Around this gaseous envelope there is a still more attennuated one, composed mainly of the lightest known element, viz., hydrogen. It is this envelope which gives rise to the peculiar flame-like protuberances that are seen surrounding the sun during an eclipse. Thanks to the labours of Lockyer and Janssen we are now enabled to examine this envelope, which is termed the Chromosphere, by the spectroscope, without waiting for an eclipse, and it has been found that it extends to an average height of 5,000 miles, that it is subject to most violent storms which sometimes raise it in clouds 50,000 miles high, leaving depressions at other parts, through which the cooler portions of the sun can be seen, thus giving rise to the phenomena known as *sun spots*. We are thus enabled by this beautiful instrument to dive deeply into the mystery of that orb which has been the wonder of all ages. But not only so, we can by its aid study those far off worlds whose light takes thousands of years to reach us, and we can also gain deep knowledge of those erratic phenomena, the comets, which have before time so terrified our ancestors by their sudden and startling appearance. What is yet more remarkable is, that, as Huggins has shewn us, it is possible to determine whether a star is moving *to* or *from* us, and even to calculate the *velocity* with which such motion is taking place; in this way he has demonstrated that Sirius is receding from the earth at the rate of 41 miles per second.

Time will not admit of my explaining to you how by the aid of the spectorscope we can also examine the nature of colouring matter in coloured solutions; how the smallest speck of human blood can be detected by the characteristic absorption bands which it produces, or how Sorby has traced the changes taking place in tree foliage from summer to winter, and many other equally interesting fields of investigation. Nor can I stay to explain to you the last, but by no means the least contribution to the subject, except to state that within the last year Sir J. Allene has shewn us that it is not

only possible by the aid of the Spectroscope to determine the *kind* of element we are examining, but that he can actually determine the relative quantity, that is, he can perform a quantitative as well as a qualitative analysis by its means.

But I may be permitted to call your attention to a more homely field of investigation with the Spectroscope, in which much yet remains to be done. I refer to the investigation of the nature of the flame from the Bessemer convertor. As many of you know, this flame is of a most intense character, throwing a shadow in broad day light, and when examined by the Spectroscope we see one of the most beautiful spectra I know of. The flame is mostly due to the combustion of carbon, but it differs in a remarkable manner from other carbon spectra, and even when we collect the carbonic oxide as it comes from the convertor (as I have done) and burn it at leisure, we get quite a different spectrum; so that although many have worked slightly at the subject, and we know that the '*blow*" should be stopped when all the green and red lines disappear, (as they do suddenly) and although some years ago I even got so far as to find that we could predict the duration of the blow from a given point, very much remains unexplained. Those persons who, like myself, have to conduct the large operations of extensive works, have little time for devoting themselves to a subject which requires constant and close attention, while other workers in science have been attracted to the more wonderful phenomena of stellar analysis. I shall be happy however to give our members an opportunity at any time of witnessing the Bessemer spectrum, as we can generally promise that there will be a "blow" going on at West Cumberland, at least every hour day and night. I will now attempt to show you on the screen, the spectra of one or two of the heavy metals, but I must point out to you that the spectra of these, as of many other bodies, are far better examined by taking the induction spark between two pieces used as the poles, and that the exhibition on the screen is coarse and rough compared with the beauty of the spectrum seen through such instruments as are on the table for your inspection.

I have endeavoured in the short time at my disposal to give you

some idea of the delicacy and beauty of spectrum analysis and also to shew you how large a field is open for investigation. I do not pretend that I have been able to shew you anything that is new, nor do I lay claim to any wonderful discoveries of my own. All I hoped to be able to do was to put before you, in simple language, a description of the Spectroscope and its use, and if possible to increase the army of enthusiastic workers with this wonderful instrument. The method of Spectroscopic investigation is not many years old, and yet it has been the means of discovering four new elements, and of explaining many phenomena before inexplicable. It has carried us as it were, to the very verge of our system, and even beyond it, enabling us to speak confidently of the constitution of our great solar luminary, to trace the disturbances that are occurring upon its surface; it has afforded us an insight into the nature of those vast orbs whose magnitude is only equalled by their distance from us, has even told us which way and how fast they are moving, and has in fact thrown more light upon the constitution of the universe, than even Galileo's great invention, the telescope. What would Newton have given for its aid, and who shall tell what discoveries it has yet in store for us? It wants only patient and careful investigators, and if my remarks induce one such to devote himself to the work, I shall feel amply repaid for the little trouble I have taken.

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RULES

OF THE

CUMBERLAND ASSOCIATION FOR THE ADVANCEMENT OF LITERATURE AND SCIENCE,

(With Additions made at the Annual Meeting, May 2nd, 1877.)

1.—That an Association be formed to be called the "CUMBERLAND ASSOCIATION FOR THE ADVANCEMENT OF LITERATURE AND SCIENCE."

2.—The Association shall consist of all members of the following Societies,* Whitehaven Scientific Association, Keswick Literary and Scientific Society, Cockermouth Literary and Scientific Society, Workington Scientific and Literary Association, Maryport Literary and Scientific Society, and of the members of such other Societies as shall be duly affiliated. Also of persons not belonging to any of the affiliated Societies, if nominated by two members of the Council; this latter class of members shall pay the sum of 5s. annually.

3.—The Association shall be governed by a Council, consisting of a President, Vice-Presidents, Secretary, Treasurer, and of ordinary members, two to be elected by each affiliated Society.

* Named in their order of birth.

4.—The President, Secretary, and Treasurer shall be elected annually at the Annual Meeting, and be capable of re-election.

5.—The Vice-Presidents shall consist of the Presidents of the various affiliated Societies; and the delegates of the various Societies shall be elected annually by their respective Societies.

6.—An Annual Meeting of the Association shall be held at such time and place as may be decided upon at the previous Annual Meeting, or (failing such appointment) as may be arranged by the Council.

7.—At each Annual Meeting, after the delivery of the President's Address, and the reading of the Reports from the affiliated Societies, the objects of the Association may be furthered by Lectures, Papers, Addresses, Discussions, Conversaziones, &c. The Council shall have the power of obtaining the assistance of persons who are not members of the Association.

8.—The Council may publish at the expense of the Association such portions of its own or of any of the affiliated Societies' communications as may be deemed advisable, subject to the consent of the author.

9.—The Council shall endeavour to promote co-operation among existing Societies, and may assist in the formation of new ones; it may also aid in the establishment of classes in connection with any of the associated Societies.

10.—Affiliated Societies shall contribute towards the general funds of the Association the sum of Sixpence for each member.

11.—The Rules can only be altered by a majority of two-thirds of the members present at an Annual Meeting. Any member desiring to

alter the rules must send a copy of the proposed alterations to the Secretary, at least two weeks before the meeting is held.

12.—Past Presidents of the Association shall be permanent members of the Council, and be described as Past Presidents.

13.—The travelling expenses of all who assist in carrying out the programmes of the various affiliated Societies shall be defrayed by the Society assisted.

The third Annual Meeting will be held at Cockermouth in the month of May, and due notice of the arrangements for the same will be issued to all members of the Association.

Members willing to bring forward Papers on subjects of original investigation or of local interest should send in the titles of the same to the Secretary.

OFFICERS FOR THE SESSION 1877-8.

——:o:——

President.

I. Fletcher, Esq., M.P., F.R.S.

Past President.

The Lord Bishop of Carlisle.

Vice-Presidents.

R. Russell, Esq., C.E., F.G.S. (Whitehaven.)
J. F. Crosthwaite, Esq. (Keswick.)
Isaac Fletcher, Esq., M.P., F.R.S. (Cockermouth.)
H. F. Curwen, Esq. (Workington.)
J. Wood, Esq. (Maryport.)

Council.

T. F. I'Anson, Esq., M.D.
William Jackson, Esq. } Whitehaven.

Alex. A. H. Knight, Esq., M.D.
E. J. Grayson, Esq. } Keswick.

Rev. W. Williams, F.G.S.
Henry Dodgson, Esq., M.D. } Cockermouth.

Geo. J. Snelus, Esq., Assoc. R.S.M., F.G.S.
A. Peile, Esq. } Workington

Rev. J. S. Craig
A. Haine, Esq. } Maryport.

Treasurer and Secretary.

J. Clifton Ward, Esq., Assoc. R.S.M., F.G.S.

Treasurer's Account for the Year ending April 30, 1877.

RECEIPTS.	£	s.	d.
Capitation Grant, 6d. per head on 678 Society Members	16	19	0
Subscriptions of Association Members (5s.)—			
7 of First year (1876)	1	15	0
15 of Second year (1877)	3	15	0
Copies of Association Transactions sold—			
668 to Societies, at 1s. per copy	33	8	0
15 to Association Members	0	15	0
1 Ex-Member's Ticket to Annual Meeting ...	0	5	0
	£56	17	0

TRANSACTIONS—800 *Copies.*

668 Copies to Societies
24 Donation copies
15 Copies to Association Members
93 Copies in hand

800

PAYMENTS.	£	s.	d.
Printing Transactions, 800 copies	36	10	0
Illustrating ,, ,, ...	7	0	0
Circulars, Printing, Stationery	5	0	6
Postage	1	14	3
Balance in favour of Association	6	12	3
	£56	17	0

Examined and found correct,

J. FISHER CROSTHWAITE.

Proceedings at the Annual Meeting, Keswick,

May 1st, 2nd, and 3rd, 1877.

The following Programme was carried out :—

PRESIDENT: THE LORD BISHOP OF CARLISLE.

TUESDAY, MAY 1st.

12-15 p.m. Opening of the Keswick Museum of Local Natural History, by the President.

1-0 p.m. Public Luncheon, the President in the Chair.

2-30 p.m. Address by the President.

3-30 p.m. EXCURSIONS, starting from the Keswick Hotel :—

ARCHÆOLOGICAL.—British Village and Druids' Circle, conducted by Mr. J. F. Crosthwaite.

GEOLOGICAL.—Giant Boulders on the Flanks of Skiddaw, above Lyzzick, conducted by Mr. J. Clifton Ward.

8-0 p.m. Lecture on "Wordsworth," by Principal Shairp, of St. Andrew's University; the President in the Chair.

WEDNESDAY, MAY 2nd.

10-0 a.m. GENERAL MEETING in the Lecture Hall.—Election of Officers and next year's place of Meeting. Discussion as to the work of the various Societies.

11-0 a.m. Reading of Original Papers :—

Section A.—*Lecture Hall.*

G. J. Snelus, Esq., Assoc. R.S.M.,—Iron and Steel Manufacture.

H. Dodgson, Esq., M.D.,—Meteorological Notes on the Cockermouth District.

J. F. Crosthwaite, Esq.,—The Rain-Fall of Keswick.

Section B.—*Museum.*

R. F. Martin, Esq., M.A.,—Notes on some peculiarities of the West Cumberland Coal Field.

D. Kendall, Esq., C.E., F.G.S.,—The Hematite Deposits of Cumberland and Lancashire.

R. Russell, Esq., C.E., F.G.S., and T. V. Holmes, Esq., F.G.S.,—The Cumberland Raised Beach between Whitehaven and Bowness.

J. Clifton Ward, Esq., Assoc. R.S.M., F.G.S.,—Remarkable Boulders of the District.

3-30 p.m. EXCURSION.

GEOLOGICAL :—Typical Volcanic Series of Falcon Crag, Keswick, conducted by Mr. J. Clifton Ward.

8-0 p.m. READINGS from the Lake Poets, with selections of Classical Music by Mr. P. T. Freeman, in aid of the funds of the Keswick Museum.

THURSDAY, May 3rd.

9-0 a.m. Excursion to Scafell Pikes conducted by Mr. J. Clifton Ward.

ADDRESS OF THE PRESIDENT, THE LORD BISHOP OF CARLISLE.

THE ANALOGIES AND CONTRASTS BETWEEN HUMAN AND DIVINE SCIENCE.

According to the programme of this Annual Meeting, the Address of your President occupies the middle place between the easy social arrangements of the luncheon table and the more serious occupation of papers and discussions which are to come hereafter. I feel that your President, in like manner, himself occupies somewhat of a middle place: by his position as the nominal head of your Association he is pledged to take interest in the progress of science and the well-being of literature, while at the same time he cannot divest himself of that character which pledges him above all things to an interest in things divine, and which makes it a necessary condition of his concerning himself with the former that the latter shall not be disparaged or forgotten.

But, indeed, every thoughtful person must, to a considerable extent, occupy mentally and spiritually something of this middle place: every human soul, which is conscious of the dignity of its own being, touches the things temporal with one hand, and reaches out towards the things eternal with the other; and while it is foolish and fanatical to interest ourselves only in those thoughts, which connect themselves with what is knowable through the processes of the human intellect, it is unphilosophical, to say nothing more, to concentrate our minds absolutely and exclusively upon this department of knowledge, so as practically to deny the existence of another department of equal importance, and possibly of deeper and more abiding interest. Hence it has occurred to me that I might, perhaps, occupy your time for a few minutes advantageously, and deliver what might, under your kind indulgence, be regarded as an address suitable to this occasion, if I discoursed to you on what may be called "the Analogies and Contrasts between Human and Divine Science." I do not wish, however, to be

tied up too closely to this title; I invite you rather to join me on a mental afternoon's excursion, with the phrase, "The Analogies and Contrasts of Human and Divine Science," as the general chart for our walk, and as a guide to bring us safely home if we should chance to wander or to lose ourselves.

I commence with a sincere apology for my apparent audacity in presuming to speak on the subject of Science; but a person, who years ago was more or less conversant with the elements of some few branches, may be able at least to take account of the progress which Science has made and is making, even though he be altogether unable to keep pace with it: just as an old post by the side of a stream may give us some notion of the rate at which the stream is running, though it remains hard and fast in its position. I think I have on some former occasion, though I forget when, quoted an amusing observation of the late Professor Sedgwick, who congratulated the Cambridge Philosophical Society on the evidence of mathematical progress, which was to be found in the fact that he himself had not been able to understand any memoir that had been read before it for some twenty years. So I also in my humbler way can mark the progress of science, while unable to follow it. I cannot quite say *Non equidem invideo: miror magis.* Certainly *miror*: perhaps to a certain extent *invideo.* The pleasure of investigation by means of those powerful helps which mathematical science supplies, or even of reading and understanding what has been done by others, is such as perhaps only mathematicians can duly, or even approximately, appreciate. Such pleasure can never again be mine; yet it is a pleasure of memory to have once known that of which I speak.

In this condition of scientific helplessness, it is a great satisfaction to be able to turn to such a book as Professor Tait's "Lectures on some Recent Advances in Physical Science." I shall make free use of this volume, partly because it supplies in a very convenient form the kind of material which I require for the purpose of some portion of this address, partly because the author is a genuine scientific man, and one who does not confound real advance in science with mere speculation or

rash unwarranted generalization. I have the less hesitation in using Professor Tait's book, because many years ago I examined him for his degree, and I remember that early in the examination his remarkable powers caught my attention, and I was confident that we had got the right man in the right place when we placed him as Senior Wrangler. Under these circumstances, you will, I am sure, admit that any theft on my part from the Professor's Lectures may be described as justifiable appropriation.

I wish then to direct your attention to two or three great advances which have been lately made in our scientific knowledge—advances which have a special interest, as bearing upon the general question of the structure of the physical universe.

Towards the knowledge of this structure we have been making steady progress for many years. The establishment of the Copernican theory was one great step: the discovery of Kepler's laws of planetary motion has been another: the theory of universal gravitation applied by Newton to explain the mechanical motion of the heavenly bodies, and the more complete development of the results of the theory by Laplace, Lagrange, and other masters in mathematical science has been a still further and a quite gigantic step. These and the like theoretical investigations, combined with almost unmeasured improvements in methods of observation, have advanced physical astronomy to an exceedingly high scientific pre-eminence, and one from which it may be safely asserted that it can never again be dislodged. Then, on the other hand, such discoveries as that by Dalton of the combination of the atoms of matter according to definite numerical proportions, and the investigations made through the microscope of small objects close at hand, corresponding to the investigations made through the telescope of distant bodies, have established another branch of physical science upon foundations hardly less secure than those upon which physical astronomy itself rests. Had our knowledge of the material universe been found incapable of advancement beyond the point which it had reached, say, forty years ago, the results would still have been splendid and absolutely marvellous to contemplate.

But it is the almost necessary result of scientific discoveries to lead on to others, and also to give unity and simplicity and consistency to the knowledge already attained: and I wish to call your attention to certain steps which have lately been made, both because they are remarkable in themselves, and because they help towards the general conclusion to which I wish to conduct your minds.

The first great step which I will mention is that which is expressed by the terms *Conservation and Transformation of Energy*. I am here using technical terms, and I am not sure whether it is possible to convey to minds which have had no scientific training precisely what is intended by the terms; but perhaps something may be done, and, at all events, it is worth while to try. Of course I might refer you to the Lectures, of which I have already said that I should make use; but I wish rather, if I can, to put the matter in a still simpler form, and to make it to some extent intelligible to persons who would not be capable of reading these Lectures, and similar scientific treatises, with much advantage or satisfaction.

Let us begin, then, with a much simpler example of Conservation and Transformation than that of Energy, namely, the Conservation and Transformation of Matter. It is, I suppose, a familiar thought with most of us, that matter cannot be destroyed. We commonly speak of destruction, but there is no such thing in nature. You burn a piece of wood, or a piece of coal, and the result is to resolve the wood or coal into its constituent parts, but those constituent parts are simply separated from each other, or compelled to combine with other substances; destroyed they never are. There is a story, I know not whether authentic or imaginary, of Sir Walter Raleigh, when smoking in the presence of Queen Elizabeth and her Court ladies a piece of the newly-introduced article tobacco, amusing the royal party by offering to weigh the smoke, the production of which was being watched with so much interest. The Court ladies laughed at the promise; but when the pipe was smoked out, Sir Walter calmly knocked out the ashes, and pointed out that if they were weighed, and the weight subtracted from that of the tobacco, as originally deposited in the pipe, the remainder would

represent the weight of the smoke. The Court ladies laughed again; but clever Queen Bess nodded her head, and said that Sir Walter had performed his promise.

This is a simple instance of the remarkable truth which all reasoning and experience confirms, namely, that matter may be variously transformed but cannot be destroyed.

Now that which is true of matter is true in a still more remarkable manner of that which is called *energy*. The word is a technical one, and I cannot very easily go into an accurate discussion and definition of it; but a very simple illustrative example may be given. Conceive two equal inelastic masses, say masses of mud or putty, to be thrown so as to meet each other with exactly equal velocities; the result will be that both will cease to move; because each will convey to the other its own energy, and as these energies are equal, neither can prevail over the other, and the bodies will be brought to rest. If one of the bodies were greater than the other, then the energy of this body would survive in proportion to its excess over the other.

It may be said, however, that in this case energy is destroyed, inasmuch as before the collision there were two bodies in motion, whereas after the collision the bodies were at rest, and so their energy gone. This is true; and the remark leads to the very pith of the subject which I am now discussing. Regarding the question as one of mere motion, it is sufficient to say that each body transfers its motion to the other, and that the result is rest; but in the process of collision and transference of motion, something else happens: *heat* is generated: it is a matter of familiar experience that to rub one substance against another, or to knock one body against another produces heat: and, speaking scientifically, when a body in motion is brought to rest by impact upon another, its energy is converted into heat. Putting this result in a more general form, we are led to say that energy and heat are convertible, that is, that energy produces heat, and that, conversely, heat may be changed into energy.

Of course I am now giving the merest hint of a grand comprehensive theory; but you will, I think, easily perceive that the theory, of

which this is the seed, may be capable of being worked out completely, and that it may be possible to determine how much heat will be represented by so much energy; or, on the other hand, how much energy will correspond to so much heat.

Let me illustrate this by an example. The sun gives out heat at a certain rate. The earth is moving in her orbit with great velocity, about eighty times as fast as a cannon ball: suppose she should impinge upon some immovable obstacle, or, what would be the same thing, upon a body exactly like herself coming the other way, then the heat supplied by this awful collision would be equivalent to that given out by the sun in about eighty days. If we imagine a still more strange catastrophe, and conceive the earth to be brought to rest, and then allowed to fall as she would into the sun, the result of her tremendous fall of more than 90,000,000 of miles would be a generation of heat which would keep the sun supplied for more than ninety years. And if the same catastrophe should happen to the planet Jupiter, which is immensely larger in mass than the earth, and much further from the sun, the result would be to produce as much heat as would last the sun, at its present rate of expenditure, for no less a time than 32,000 years.

The result of this law of the Conservation and Transformation of Energy is to give us quite a new insight into the economy of Nature. All kinds of forces are subject to it, whether they arise from gravitation, electricity, magnetism, or what not. Energy can, in all cases, only be transformed: we can no more create it than we can create matter. We burn coal, and we change the heat which we produce into steam power: the power of the engine is merely the heat of the coal in another form.

And it is not difficult to see how vast are the fields of inquiry and speculation which are opened by a theory of this kind: it helps us to speculate upon the possible past, and throws also some light upon the possible future. There is just one such speculation to which I will call your attention, in consequence of its great interest.

I refer to the question of the probable extent of time, during which something like the present state of things has existed upon our globe. Sir William Thomson has discussed this question in three different ways;

all, however, depending upon considerations of heat or of energy; and the result to which he has come is that he cannot grant more than about 10,000,000 years for the production of all those results to which Geology bears witness. You may think this a tolerably liberal allowance; but some of the Geologists and Mr. Darwin appear to think that even 300,000,000 of years would be insufficient for the work to be done, which has actually been accomplished. Professor Tait says that if Geology really cannot do without so long a period, so much the worse for Geology, inasmuch as the theory of heat and energy cannot, in its most liberal mood, grant it anything like such a long innings. I do not regret this present apparent conflict between different sciences; it is by such conflicts that truth is not unfrequently secured; if upon more careful inquiry it should appear that Geology and other natural sciences cannot have so much time to expatiate in as has been till lately imagined, I doubt not that further investigation will prove that the enormous length of time is not really required; ultimate harmony will assuredly prevail amongst the sciences, however different may be the starting points of their respective investigations.

Let me say a word here upon the term *Theory*, as I have been lately using it. I have spoken of the *Theory* of the Conservation and Transformation of Energy; and you may speak, if you please, of Mr. Darwin's *Theory* of the Transformation of Species, and you may be disposed to say that one Theory is as good as another. But it should be borne in mind that when a Mathematician speaks of a *Theory*, he generally means something different from speculation, different from ingenious guess, different from plausible hypothesis: he speaks of the Lunar Theory, the Planetary Theory, the Undulatory Theory of Light, and so forth, as doctrines respectively concerning the Moon, the Planets, and Light, which can be proved to be true by such evidence as no reasonable man, who follows the steps of the investigation, can find it possible to doubt. These Theories are absolutely different in kind from mere hypotheses which cannot be verified; and it is in this sense that we speak of the *Theory* of the Conservation and Transformation of Energy. I cannot, of course, prove to you in an address like this that the Theory is of the

kind that I have described ; I can only state that it is so received by all competent persons; and that this being so, it must be regarded as a great fundamental truth to which all the conclusions of science must of necessity be subject.

Hitherto I have been speaking, directly or indirectly, chiefly of *heat :* it is the investigation of the nature of heat, principally due (it may be said with satisfaction) to Mr Joule, a countryman of our own, that has given the enormous advance in our physical knowledge, which I have pointed at, rather than described. Let me turn now to *light.* Heat and light generally go together, and they have both been the fields recently of great discoveries, though in very different ways.

Light, as almost every one is supposed to know now-a-days, is due to the vibrations of a fine elastic medium, very much in the same way as sound is due to the vibrations of the air. The undulatory, or wave theory, of Light, as it is called, has been for some time recognized as established ; and a vast number of complicated phenomena have been worked out mathematically upon the wave hypothesis in such a manner as to leave no doubt upon the minds of those who can follow the investigations, that the hypothesis must be sound. Of late, however, the discoveries made concerning the nature of light have been diverted, as it were, from light itself to the universe, in which light is so important an agent, in a manner which cannot be passed over by any one who is touching ever so slightly upon recent advances in Science.

Some of those, to whom I am speaking, will probably be acquainted with the nature and results of Spectrum Analysis ; it is a great question whether it will be possible for me to make intelligible to others the principles upon which the analysis is based. I should utterly have despaired of doing so, had it not been for the lucid pages of Professor Tait; whether his light, when further refracted through the medium of my brain, will continue to be luminous may be gravely doubted. But with your kind acquiescence the attempt shall be made.

We will start with sound, the analogy of which with light is frequently most helpful. Every one knows that if he whistles or sings the note to which a tuning fork, or stretched string, or even a China

basin corresponds—the fork, string, or basin will be put in vibration and will give back the sound. Suppose now that you have a box, open at the two opposite sides, and full of tuning forks corresponding to the same note, and suppose you sound that note: you put all the forks very slightly in vibration. What will be the consequence to a person on the other side of the box? This, that it will be difficult for him to hear the sound which you make; because the vibrations which you produce are used up in passing through the box by setting the forks in motion. Any other note the person on the other side would hear quite well: the one note which he cannot hear, which is in fact absorbed, is the one which the tuning forks would themselves give if made to vibrate.

Now bear in mind the analogy between sound and light, and you will not have much difficulty in perceiving that a certain kind of light, which belongs to a particular substance, may be in like manner absorbed by having to pass through that very substance which would itself emit the kind of light in question.

If I were to go beyond this rough and most elementary, though highly ingenious explanation, I fear that I should not be able to stop short of a discussion which would be quite unsuitable to the purpose and limits of this address. I shall therefore assume that by means of the scientific apparatus of the spectroscope, it is possible to analyze the light which comes from any luminous source; the light coming from one source is as clearly distinguished from that coming from another, as the sound of a flute is different from that of a violin; incandescent hydrogen gas, for example, will have certain unmistakable characteristics,—certain bright lines in its spectrum, as scientific men say—and if other light is made to pass through this incandescent gas, it will produce an effect upon that light, according to what has been already said, by absorbing those very portions of the light which are characteristic of itself when used as a source of illumination.

Examining the light which comes from distant bodies, by the method of the nature of which I have endeavoured to give just the slightest indication, we arrive at very remarkable results. The Spectrum

Analysis enables us to tread with firm step in regions of nature, which previously might well have been regarded as absolutely inaccessible; light is as true a messenger as sound, and in some respects we become as conversant with what is going on in the remote regions of the universe, as if we had correspondents in those regions who could report to us *vivâ voce.*

By this method of investigation we can assert that a variety of substances known upon the earth's surface are to be found in the sun; for example, iron, magnesium, manganese, cobalt, chromium, sodium, titanium, calcium have been identified. And it has been further proved that the sun emits from its surface grand jets of blazing hydrogen gas, some 70,000 miles high.

There is still another application of this kind of analysis, which I will not tax your patience by endeavouring to explain, but the results of which are so curious that I may well refer to them. It is possible by the examination of the light coming to us from a certain distant body to ascertain whether that body keeps its distance from us, or whether it is approaching or receding. By observations made upon the well-known star Sirius, commonly called the Dog Star, it has been shown that the distance between that star and the sun is increasing at the rate of about 20 miles a second. This increase of separation has apparently been going on ever since Sirius was first known and observed, and yet there is no evidence that the apparent brightness of that star has been perceptibly diminished. I need hardly say what a magnificent conception is thus given us of the enormous grandeur of Sirius, regarded as a luminous body.

But I pass away from this fascinating subject, merely adding that the spectrum analysis is almost in its infancy, and that it is impossible even to guess what may be the extent of direct knowledge in store for us with regard to the heavenly bodies, whether stars, planets, or comets, and with regard to phenomena such as the Aurora Borealis, to which an investigation by means of light is applicable. The limits of scientific knowledge, if limits there be, are certainly very far from being yet reached. Newton was nearer to the truth, than perhaps even he with his

far reaching intellect and his modest estimate of himself was able to perceive, when he spoke of having picked up a few pebbles upon the shores of the vast sea of truth. While however this is true, and while we gratefully acknowledge not only the marvellous character of the physical universe, but still more the marvellous gift of intellect which has enabled us to comprehend to some extent the wonders of that universe, I think it is well that we should bear in mind, that the ultimate foundation upon which the fabric of nature stands is almost, if not quite, as dark and mysterious and unknown, as it was in olden days, before genuine science had commenced its mighty and glorious career.

For what *is* that physical universe which we examine with such care, and in which we make such wonderful discoveries? We know to a great extent of what the earth is made; and, as we have already seen, science has lately been able to tell us something as to the materials of the sun itself; and we are not content with a rough classification of materials, but we have already been able to reduce the ultimate elements of which matter is composed to very few.* Possibly the analysis is not yet complete, and conceivably we may arrive at the discovery of one ultimate entity of which every material substance is composed; but what will be the nature of that ultimate entity, and how much nearer shall we be to the first cause and ground of existence, when we have reached this at present distant goal? This is not properly speaking a scientific question. A scientific man would say, "Such questions are no business of mine; all that I have to do is to go on discovering truth." But the question is one which *I* may very well ask, having reference to the general scope of this Address, as announced at the opening of it; and I may ask it in connection with the discussion of the "Structure of Matter," which occupies two chapters of the volume, to which I have already referred as my help and companion in the composition of the remarks which I am now laying before you.

I shall pass over the rough suggestions of Lucretius, which, notwithstanding the favour they have lately found in the eyes of an eminent

* "All organic compounds, derived from the animal and vegetable kingdoms, are composed almost wholly of four elements—Oxygen, Hydrogen, Nitrogen, and Carbon."—*National Cyclopædia*, Art: "Atomic Theory."

man of science, appear to me to be scarcely worthy of being regarded as even an approximation to the solution of the problem. I pass over also for other reasons the speculations of Newton, Boscovich, and others; and I come to the latest suggestion of all,* namely, that of Sir William Thomson, which is, that "what we call matter may really be only the rotating portions of something which fills all space; that is to say, vortex-motion of an everywhere present fluid." To say that a suggestion is made by Sir William Thomson is to say that it is worthy of all consideration from scientific men; and to such a jury, rather than to the mixed audience which I have the honour to address to day, I should be disposed to leave the determination of the value of the suggestion concerning matter which I have just now quoted. In truth, it would be impossible for me, on an occasion like this, even to put before you some of the considerations, upon which alone any solid opinion could be formed; but what I wish to bring under your notice is this, that the hypothesis in question concerning matter postulates "something which fills all space." What can that something be? If it be not matter, what is it? I do not say that it does not exist, though the actual conception of something filling all space is manifestly impossible to the human mind; the thing may however be assumed for argument's sake to be capable of existence, though, in consequence of an inherent infirmity of the mind, this existence may not be thinkable. But granting all that can be required for the purpose of making Sir William Thomson's hypothesis a possible one, do we really do more than drive back the existence of matter one step further? Do we do more than arrive at the conclusion, that matter is something, which is something else under certain peculiar conditions? Is not the all pervading fluid merely the raw material, out of which is formed by vortex-motion those atoms of which Professor Clerk Maxwell speaks as having much of the character of "manufactured articles"?

You will quite understand that I am by no means desiring to speak lightly of this hypothesis. Professor Tait says,† "With a little further development the theory may perhaps be said to have passed its first trials at all events, and, being admitted as a possibility, left to time

* "Recent Advances in Physical Science," p. 290. † Do., p. 300.

and the Mathematicians to settle whether, really, it will account for everything already experimentally found. If it does so, and if it, in addition, enables us to predict other phenomena, which, in their turn, shall be found to be experimentally verified, it will have all the possible claim on our belief that any physical theory can ever have." This will all be readily granted, and I for one wish the theory all success; but I think I am not wrong in saying, that if it be found to be true, the mystery of existence,—the ultimate question, what *is* this material universe? —will be very much where it is now.

All scientific achievement seems to lead to the same conclusion, namely, that human investigation can move freely for a long distance, we know not perhaps as yet how great the distance may be, but that there are certain limits imposed by Him who made us which we cannot pass —*sunt certi denique fines.* There is a charming little French book, which I would recommend any intelligent person to read, entitled "L'histoire d'une bouchée de pain." It has, I believe, been translated under the literal title, "The History of a bit of Bread"—but I should recommend the original, because the French language lends itself with peculiar happiness to the style of exposition which the author has adopted. Let me, however, tell you what the book is, and why I refer to it. It is in reality a popular exposition of the process, by which food is assimilated by the living body. The food is followed, through all its processes of change, till it is formed into arterial blood, and till in this condition it circulates through the body and supplies the waste and becomes itself transmuted into the various substances of which the body is composed; skin is formed here, muscle there, hair in a third place, nail in a fourth, and so on. But how this is done the ingenious author cannot tell us: there is an absolute hiatus between the manufacture of the material, and the appropriation of the material to its purpose. Here comes in the mystery of *life*: and when we reach that mystery, we seem to find ourselves in sight of a lofty barrier which can in no wise be passed. The existence of this barrier is seen very conspicuously in the "History of a bit of Bread," and that is why I have referred to the book; it illustrates in one familiar department the law which

appears to be quite universal, namely, that all nature furnishes us with abundant fields of investigation, that the amount of knowledge to be obtained is practically unlimited, but that in every direction we perceive if we go far enough the existence of an absolutely impassable barrier; we become aware that beyond the vast fields of the knowable and the known there is an infinite region of the unknown and unknowable, which the human intellect cannot penetrate, strive and struggle as it may.

This consideration leads to the obvious remark, that it can be no objection to any science that it runs into mystery, or involves the unknown or the inconceivable. If this be the case, as undoubtedly it is, with physical science, which beyond all others deals with the seen, the palpable, the sensible, *á fortiori* it is likely to be the case with other sciences, which deal more especially with the unseen and the spiritual. But the analogy of the physical sciences may teach us, that, while there are confessed limits to the investigations of the human mind, there are still almost infinite fields of inquiry, which are quite free and open to all comers, and in which admirable discoveries have already been made. To be more definite as to the point at which I am aiming, I would say that there may be a true knowledge of God, a genuine Science of Theology, in which there may be abundance of room for the expatiation of all thoughtful earnest minds; and yet the science may begin in mystery as human science ends in it; and it may be as wrong to put down theology by the objection that God cannot be known, as it would be to try to hamper physical science by the objection that the nature of Matter is inconceivable. Some would have us substitute for the knowledge of God, in other words, for divine science, what they call *Agnosticism*: the Altar at Athens is supposed after all to have had more wisdom in its inscription than St. Paul supposed: but the fallacy of the proposed substitution is seen, when we consider how easy it is, nay, how necessary it is, for all thinking persons to grant that in a certain sense God must be unknowable, and how foolish it is to regard this admission as at all equivalent to this other assertion, that nothing can be known about God. Once more I take the analogy of Physical Science; and I say that Matter is unknowable; but I ask whether this admission proves

that no knowledge of Matter is due to the discoveries of Newton, and of all that glorious band of which he may be regarded as the head, that Physical Science is a delusion, and the alleged "Recent Advances" a dream?

I am thus led to make a few remarks upon the respective origin and principles of each. Dr. Whewell dealt with the whole field of Physical Knowledge, under the title of the History and Philosophy of the "Inductive Sciences." Those who have read these works will remember the almost dramatic form in which Dr. Whewell's genius has presented the subject. There is first the prelude to some great discovery, when previous discoveries have turned men's minds in a particular direction and it is felt that some great mental movement is at hand. Then there is the happy thought, the inspiration of genius, what in a lower subject matter we should call the felicitous guess. Then comes the verification, the appeal to facts, the rigid tests of mathematical calculations and numerical results, and above all the prediction of consequences subsequently found to be true. And each discovery reaches on towards some other, and even the detection of residual errors in previous conclusions becomes a specially fertile source of further progress. Guessing, doubting, testing, correcting—may be said in homely phrase to be the efficient engines of scientific motion; and the Inductive Sciences may find an incidental justification of their name in the fact, that they *lead on* from one point to another, that each discovery induces another, that another, and so on (it may be) *ad infinitum*.

Now, divine science presents a remarkable contrast in regard to the qualities which have just been mentioned as belonging to physics. Divine science is as essentially *de*ductive as physical science is *in*ductive: *de*ductive processes are of course required in following out results in physical investigation; and in like manner *in*ductive processes may be available and necessary in investigations connected with certain branches of Theology; but still the basis of divine science does not depend upon happy guesses, nor upon an accumulation of verifications; neither does it offer an infinite field for progress, nor does its success demand that same kind of chronic scepticism which is so useful, or even essential, in

the case of natural science. On the other hand, it professes to rest upon ultimate truths, which are made known to mankind either by a moral instinct, in virtue of which man is man, or by that revelation from God which religion necessarily postulates, and of which man alone of all earthly creatures is susceptible.

I shrink from introducing into an address of this kind illustrations drawn from the highest source of religious knowledge, namely, the message delivered to mankind by Him whom we regard as both God and man; though I would just remark by the way, that I can find nothing essentially opposed to the knowledge attainable from other sources, in the idea of such a message. But I shall be content with a much humbler illustration of the point which I am endeavouring to enforce just now. I will suppose a father to be walking in the country with young hopeful, aged we will say twelve years, more or less, and endeavouring to improve his mind. Pater discourses upon geology, and points out various features in the rocks illustrating this or that; he finds, we will suppose, that his companion, instead of swallowing all that is told him whole, bolting it undigested, or apparently regarding the paternal lecture as a bore, asks some awkward but most pertinent question which it is difficult to answer; the boy in fact doubts; he is not convinced by what his elder tells him; he determines to think about the matter, to observe for himself, and then try to make up his mind. What does the father think of this? Is he offended or frightened? Not at all. He says, "That boy has got the making of a man of science; he will inquire for himself; he will be somebody one of these days." And papa and mamma rejoice together. But suppose that in the course of the excursion the conversation should fall, not upon rocks and stratification, but upon some moral subject, such as *truth*: and suppose that the youth should shew himself, like Pilate, sceptical upon *this* point, and that with a precocious freedom of thought he should express the opinion, that there was no great difference between truth and falsehood; and that he should announce his intention of regarding the question of lying as an open one at present, to be decided perhaps in future by observation of consequences. Would the father go home as comfortable under

these circumstances as under the former? Would he not see ruin and misery for his son in mature life? Might he not even be tempted to lay the foundation of a respect for truth in an immediate application of the birch rod?

This familiar illustration might be added to and enforced abundantly if necessary: but it will probably be sufficient by itself as an indication of the contrast upon which I am now dwelling. It may be added that, as analogy is not identity, so contrast is not contradiction. I think we may well compare human and divine science, or (if we please so to describe them,) physical science and spiritual, to the military staircase which some of us have seen in Dover cliff, or to the similar construction of the famous S. Patrick's well at Orvieto. These staircases are double, and consist of two spirals like each other, supported by one central column, but such that a body of men can ascend by one while another body of men simultaneously and without interference descend by the other: their support is, as I have said, the same; they are inextricably intertwined with each other, and the beginning and end of them are identical, only that one ends where the other begins, and begins where the other ends. The physical sciences begin from below, and wind upwards towards heaven, while religious truth starts from heaven and descends earthwards: but neither needs to jostle with the other, and both in reality revolve about the same central column and rest upon the same foundation.

It is perhaps a misfortune of this particular epoch of scientific history, that one can scarcely speak of the progress of science without being tempted to say something of its moral and religious aspects. If I am not mistaken, there was comparatively little of such temptation fifty years ago. It may be that the particular fields in which science was then chiefly at work did not give occasion to so much anxiety as to a possible collision between human knowledge and divine: it may be that the great popularization of physical knowledge in latter years, and the consequent approximation of the physical and the moral in the minds of the thousands of intelligent persons who nevertheless have received no real scientific training, may have introduced a danger

which did not exist to any great extent before. It may be also that a certain rashness of speculation, and a tendency to introduce speculation into regions which ordinary people profoundly feel not to be the exclusive property of scientific men may have tended in the same direction. When, for example, a man of high scientific position announces to us, as a result of his investigations, that our great great great grandmothers were hairy creatures, presumably not very easily distinguishable from certain half-human looking brutes which may be seen in our own time in the Zoological Gardens,—it is not much to be wondered at if many of us should begin to feel that physical science was treading upon somewhat delicate ground. Our fathers perhaps we might have left to take care of themselves; but to give our mothers beards, and to suppose that they had sloughed them off only in comparatively late times, in deference to a growing taste on the part of their mates,—may fairly be regarded as rather hard to be swallowed, and somewhat unpleasant when it has been. Nevertheless, I am persuaded that in the case of all such rash speculations, our "strength is to sit still." No such speculation need ruffle our tempers: still less need it make us full of alarm lest important moral or religious truths should be in jeopardy: we may be quite sure that false hypothesis, and unwarranted generalizations, will not live long; that if they have any seed of truth in them, that seed will take root and survive; and that if they are wholly false, they will sooner or later perish altogether. "Magna est veritas, et prævalebit," is the motto at once for a student of Physical Science and for a student of Theology; it may be written with equal propriety over the door of a lecture-room and over the porch of a church; it ought to be as dear to the President of a Scientific and Literary Association, as it is to a Bishop of the Church of Christ. I am quite sure that the more thoroughly we realise this, and the more completely we agree to regard truth as the common treasure of us all, the greater will be our happiness in seeking that treasure, and the greater our chance of finding it.

But it is time that I should be drawing this address to a close. I have discoursed concerning Science and its advancement, to as great an extent probably as your patience and your courtesy combined are willing

to permit; and I feel that, having reference to the title of our Association, I owe a certain amount of apology to "Literature," for having paid all my attentions to her younger sister, and for having seemed so rudely to neglect her not inferior beauty and her rival charms. Literature, however, will have any rudeness on my part more than compensated to her this evening, when we have the pleasure of listening to a discourse on one of the few great modern English poets, delivered by one of the few men who are capable of doing that great poet justice.* Perhaps, also, I may be permitted to add, inasmuch as the remark to a certain extent illustrates the subject of this address, that although our Association describes itself as one for the "advancement of Literature and Science," still, the kind of advancement which is possible, and which is being continually carried out, with respect to Science, is impossible with regard to Literature. Probably no man has ever yet lived who had in greater perfection the true scientific mind than Sir Isaac Newton; certainly no man ever made such advances in science; and yet, by the necessity of the case, the science of Newton was but a rude and contracted body of knowledge as compared with the science of those who have stood upon his shoulders, and who have inherited his achievements. And the men of to-day will be but as children by the side of the men of the next century; and many of the grandest and most cherished results of the science of to-day may be looked upon by our successors as familiar knowledge. But in Literature this is not so. Shakspeare occupies in this respect a prouder chair than Newton. Shakspeare may safely smile upon the efforts of Associations for the advancement of Literature, if by the phrase is meant such an advance as shall supersede "Hamlet" and "Macbeth" in the manner in which the "Principia" and the "Optics" have been already superseded. There may be an improvement in the general quality of the Literature of a country: the historians may be more candid and pains-taking; the novelists may be less trashy, and higher in their tone; the manner and the matter of the thousand and one volumes, which each year produces, may be on the whole in better taste, and of more sterling value: but the giants of the past, specially the giants of poetry, can be surpassed by no

* Lecture on "Wordsworth," by Principal Shairp.

process of advancement similar in kind to that which takes place in the case of science; and if ever Shakspeare should find himself second in the list of poets, according to the verdict of English-speaking men, it will be the result of no steady hard-won progress, but because some God-sent poet greater than himself has been granted as a gift to mankind.

Here, however, I see the opening of a field of thought upon which I dare not enter. Let it suffice to remark that, if our Association cannot advance Literature, as in fact no association can, it can at least encourage the study of it, and lead people to read and enjoy and profit by those many masterpieces of literary power, which are perhaps the chiefest secular blessing that we possess, and the purest source of intellectual pleasure.

It remains that I congratulate you upon the progress and prosperity of our Association. We consist now of branches at Whitehaven, Keswick, Cockermouth, Workington, Maryport; and I understand from the best authority, that an increase of our family may be shortly expected at Harrington. I have looked through the programmes of the lectures, which have been given during the past winter, and am surprised by their variety and by the number of the lectures. Certainly our Association does seem to be the exciting cause of a great amount of intellectual energy in this district. It is not easy to measure results, and the mere listening to lectures does not necessarily inform the mind; still I cannot but believe, upon the evidence before me, that the Association *is* doing good work in many more ways than one; and therefore I heartily wish it continued success; and I feel that it is both a pleasure and a duty to endeavour to promote that success by any efforts in its behalf, which it may be practically in my power to make.

REPORTS FROM THE ASSOCIATED SOCIETIES.

WHITEHAVEN SCIENTIFIC ASSOCIATION,

HOWGILL STREET.

SESSION, 1876—1877.

President ... ... JAMES BAIRD.
Vice-President ... ... R. RUSSELL, C.E., F.G.S.

Past Presidents.

T. F. I'ANSON, M.D. | WILLIAM JACKSON, J.P.
AUGUSTUS HELDER. | W. H. KITCHIN.
H. A. FLETCHER, F.R.A.S.

Committee.

E. ABLETT, M.D. | R. F. MARTIN.
JOSEPH ADAIR. | J. W. MONTGOMERY, F.C.S.
ARCHIBALD KITCHIN, F.C.S. | R. PICKERING, C.E.
JOHN VIVIAN, C.E.

Curators.

Botanical } ... ... { JOSEPH ADAIR.
Zoological } ... ... { E. ABLETT, M.D.

Geological } ... ... { R. PICKERING, C.E.
Mineralogical } ... ... { R. RUSSELL, C.E., F.G.S.

Archæological ... ... { T. F. I'ANSON, M.D.
W. JACKSON, J.P.

Treasurer. ... ... JOHN S. HELLON.
Hon. Secretary. ... ... B. TAYLOR.

MEETINGS were held during the Session as follows:—

Oct. 17.—Conversazione—Introductory Address by the President.

Nov. 7.—Rev. S. T. TAYLOR-TASWELL, M.A., Christ Church, Oxford—On Ancient Slavery in Relation to Roman Jurisprudence.

Nov. 21.—RICHARD A. PROCTOR, B.A., Hon. Sec. Astronomical Society, London —On the Giant Planets (Illustrated).

Dec. 5.—J. D. KENDALL, M.E., F.G.S.—On the Theory of Evolution.
Dec. 18.—W. H. WATSON, F.C.S., F.M.S.—On the Food of Plants.
Jan. 9.—J. HUGHES—On Steam Boilers.
Jan. 23.—R. F. MARTIN—On Optical Instruments. (Illustrated).
Feb. 6.—Right Hon. G. C. BENTINCK, M.P.—On Modern Architecture.
Feb. 20.—J. EATON, M.D.—On the Eye: its Structure and Development.
March 6.—T. F. I'ANSON, M.D.—On the Sense of Touch.
March 20.—J. C. WARD, F.G.S.—On the Ear: its Structure and Development.
April 3.—W. WILSON—On Linen and the Linen Trade.
April 17.—CONVERSAZIONE—Election of Officers, &c.

Hour of Meeting 8 p.m.

During the past year some very good work has been done; and although the entire expenditure of the Society has been about £181, which included an extraordinary item of £121, the ordinary annual expenditure was well within the annual revenue.

During the session 61 new members have been elected, and the number of members whose names have been removed from the Register—death or removal to some other part of the country being the chief cause—amounts to 29, leaving a nett increase of 32.

The session opened in a very auspicious manner, the conversazione being very largely attended by members and friends of the Association. A new feature in the past session has been the engagement of Mr. Proctor, the eminent and popular lecturer and writer on Astronomy, who gave his instructing and interesting lecture "On the Giant Planets" to a large and appreciative audience of members and non-members. The success that attended this action of the Committee far exceeded their expectations. The programme of the Association has also included a paper from the Right Hon. G. C. Bentinck, M.P., "On the Decline and Fall of British Architecture," a Lecture which has since been fully discussed in the Architectural Journals. These two Lectures were given in the Town Hall.

The other nine Meetings at which papers were read, were held in the Association Rooms, in Howgill Street. Of nine papers, one was literary, three were physiological, and five were on various other scientific subjects. The last meeting of the session was a conversazione, when

the Secretary's and Treasurer's Reports were read and passed, and the Officers and Committee elected to serve for the present year.

The Astronomical sub-section has also had an active session, during which Mr. Martin delivered a course of twelve lectures, and also conducted the same number of class meetings. This section numbered twenty-eight members—four ladies and twenty-four gentlemen; the average attendance was fourteen. The lectures were free to the public; they were also attended by many members of the Association who did not join the class. These Lectures were given in connection with the Cambridge University.

Several additional specimens have been added to the various departments of the museum. Much remains to be done in the way of classifying and arranging the specimens which the Association possesses.

At the commencement of last session, a Library was started, which has received considerable support. All things considered, the position of the Association, and the work it has accomplished during the year, the Committee flatter themselves that their labours have not been in vain.

KESWICK LITERARY AND SCIENTIFIC SOCIETY.

8TH SESSION, 1876—1877.

President	J. CLIFTON WARD, Esq., F.G.S.
Vice-President	A. H. KNIGHT, Esq., M.D.
Secretary	E. J. GRAYSON.
Treasurer	R. R. LOWTHIAN.

Committee.

Rev. CANON BATTERSBY, M.A.
Rev. W. COLVILLE.
Rev. A. HOWSON.
JOHN FISHER CROSTHWAITE.
Rev. S. STREETEN, B.A.
J. BIRKETT.

MEETINGS were held during the Session as follows:

SUMMER SESSION.

FIELD MEETINGS.

April 18.—Geological Excursion to the Granite and Metamorphic Rocks of Skiddaw Forest and Glenderaterra Valley.

May 1 and 2.—Annual Meeting of the Cumberland Association for the Advancement of Literature and Science, at Whitehaven.

June 7.—Excursion to the Goldscope and Yewthwaite Mines, Newlands Vale. Mineralogical, Geological, and Botanical.

July 5.—Archæological and Geological Excursion to Cockermouth Castle and The Clints (Limestone rocks). Joint Excursion with the Cockermouth Society.

Aug. 2.—Excursion to Grasmere, visiting Easdale.

Sept. 2.—Geological Excursion to High and Low Rigg (St. John's Vale.)

WINTER SESSION.

ORDINARY MEETINGS.

Held in the Keswick Library at 7-30 p.m.

Oct. 16.—The President—Jonathan Otley.

Nov. 6.—Mr. J. Richardson—Old Customs and Usages of the District.

Nov. 27.—Mr. J. F. Crosthwaite—Celebrated Lake Visitors. (Continued.)

Dec. 11.—Microscopic Soiree—Short addresses on the Microscope and Microscopic Work.

Jan. 16.—Mr. John Birkett—Birds of the District.

Jan. 29.—Mr. George Lowthian—Self-culture

Feb. 12.—Dr. Knight—The Gottenburg System.

Mar. 12.—Mr. J. Bromley—Burial Customs

Mar. 26.—Mr. P. Thompson—Dr. Kitto.

Election of Office Bearers.

LECTURES.

Held in the Keswick Lecture Hall at 8 p.m.

Oct. 30.—A. Kitchin, Esq., F.C.S.—Some of the Elementary Principles of Light, (experimentally illustrated.)

Nov. 20.—James Baird, Esq., President of the Whitehaven Society—Some of the Elementary Principles of Heat, (experimentally illustrated).

Dec. 4.—J. Clifton Ward, Esq., Assoc. R.S.M., F.G.S.—Some of the Analogies between Sound and Light, (experimentally illustrated).

Dec. 18.—Rev. Canon Dixon, M.A.,—Some of the Great Principles and Forms of Poetry, as developed by the English Poets.

Dec. 27—Rev. W. Knight, Professor of Moral Philosophy at St. Andrew's—The Rise of Great Cities.

Jan. 22.—R. F. Martin, Esq.—The Sun as a Source of Light and Heat.

Feb. 5.—Rev. J. D. Harrington, M.A.—Coleridge.

Feb. 19.—C. Lloyd Morgan, Esq., Assoc. R.S.M., F.G.S.—Sketches in North and South America.

Mar. 5.—R. S. Ferguson, Esq., M.A., LL.M.—Heraldry.

Mar. 19.—Rev. J. Collingwood Bruce, LL.D,—The Roman Wall.

The number of members is now 177.

The summer field-days were five in number, exclusive of the excursions in connection with the Association Meeting at Whitehaven, and were all well attended, papers being read at each meeting.

The winter programme has been more successful than in any previous year, both ordinary meetings and lectures having been attended by greater numbers than in former years. There were nine Ordinary Meetings, including a highly successful microscopic soiree; and the papers brought forward were generally speaking entirely original in their nature. The Public Lectures were ten in number, four of them bearing upon the principles of light, heat, and sound; two of them upon poetry; and the rest upon various subjects, among which should be specially mentioned those of Professor Knight on "The Rise of Great Cities," and Dr. Bruce on "The Roman Wall."

The Local Museum of Natural History has made considerable progress; so much so, that the Society felt itself justified in taking advantage of the occasion of the visit of the Association for a public opening of the same. The collection is wholly confined to specimens illustrating the Natural History and Antiquities of the District, and may be thus briefly summarized.

Zoological Collection	... ...	700 specimens
Geological ,,	... ...	1368 ,,
Antiquarian ,,	... ...	71 ,,
Woods of the District	... ...	41 ,,
Lichens of the District	... ...	238 ,,
Remaining Botanical Collection, very considerable, but not enumerated		
		2418 specimens

exclusive of the remaining botanical, and of various maps, models, &c.

It is confidently hoped that the Museum, having attained this degree of development, may in future be made available for systematic instruction in some of the various branches of natural history.

COCKERMOUTH LITERARY AND SCIENTIFIC SOCIETY.

SESSION, 1876—1877.

President ... ... ISAAC FLETCHER, Esq., M.P., F.R.S.

Vice-Presidents

Rev. W. WILLIAMS, F.G.S.
HENRY DODGSON, M.D., F.R.A.S., F.M.S.

Committee

Mr. JOSEPH BROWN.
Rev. ELDRED GREEN.
Mr. JOHN ROBERTSON, M.D.
Mr. THOMAS M. HARRIS.
Mr. HORACE R. WYNDHAM.
Mr. WILLIAM YOUDALE.
Mr. JOHN SIMPSON.

Secretary ... ... Mr. J. H. PICKERING.
Treasurer ... ... Mr. R. C. SHAWYER.

LECTURES were delivered in the Court House, Cockermouth, during the Session, as follows :—

November 2.—Some of the Phenomena of Light, (experimently illustrated.) By A. KITCHIN, F.C.S.

November 16.—Some of the Phenomena of Heat, (experimentally illustrated). By JAMES BAIRD.

November 30.—Some of the Chemical Relations of Light and Heat, (experimentally illustrated). By G. F. DOWNAR.

December 14.—Electro-Chemistry, (experimentally illustrated). By J. C. WARD, F.G.S.

January 11.—History of the English Language. By J. GORDON.

January 25.—Gothic Architecture. By the PRESIDENT.

February 8.—Some of the Laws of Thought. By the Rev. W. WILLIAMS, F.G.S.

February 22.—Fletcher Christian, and the Pitcairn Islanders. By W. FLETCHER, F.G.S.

March 8.—Old Customs and Usages of the District. By J. RICHARDSON.

March 22.—The Character of Hamlet, (Papers). By M. EDWARDS, J. STRAUGHTON, F.R.G.S., and J. H. PICKERING.

Close of Session, Business, and Election of Officers.

A joint Field-day was held in connection with the Keswick Society, on July 5th, when the Clints Crags, near Cockermouth, were visited, and the Geological features described by J. Clifton Ward, Esq.

A Class for the study of Chemistry was held during the Winter, conducted by Mr. G. F. Downar. At the concluding Examination six members competed for the Prizes offered, and Mr. Downar reports—"All the Papers displayed a considerable amount of knowledge, and I am very pleased with them."

The attendance of members at the General Meetings has not been very satisfactory, and with one or two exceptions compares unfavourably with that of previous Sessions.

The number of members upon the Register this Session is 130.

WORKINGTON SCIENTIFIC & LITERARY ASSOCIATION.

SESSION 1876—1877.

President	H. F. Curwen, Esq., J.P.
Vice-President	Rev. J. J. Thornley, M.A.
Treasurer	Alfred Peile.
Hon. Secretary	Geo. F. Downar.

Committee.

Henry Bowes. | Thomas Iredale.
Chas. Hindmarsh. | Tom Milburn.
George J. Snelus.

During the Session the following Lectures were delivered in the Savings Bank Large Room; except that on Nov. 22nd, which was in the Assembly Room, when the general public were admitted.

Nov. 8.—G. F. Downar—On Artificial Illumination, (experimentally illustrated.)

Nov. 22.—Richard A. Proctor, B.A., Hon. Sec. Astromonical Society, London —On the Giant Planets. (Illustrated).

Dec. 6.—H. F. Curwen, Esq.—On Ancient Coins and Medals.

Dec. 20.—J. Clifton Ward, Assoc. R.S.M., F.G.S.—On Coal: its history.

Jan. 10.—R. Russell, C.E., F.G.S.—On Coal Mining.

Jan. 24.—J. Bolton—On Lord Byron.

Feb. 21.—R. Russell, C.E., F.G.S.—On the Iron Ores of Great Britain.
Mar. 7.—G. J. Snelus, Assoc. R.S.M.—On the Manufacture of Iron and Steel.
Mar. 21.—Thomas Thompson—On Thomas Carlyle.
April 4.—J. Clifton Ward, Assoc. R.S.M., F.G.S.—On Magnetism and Electro-Magnetism, (experimentally illustrated).
April 11.—C. Strang, M.B.—On Pauperism: a Sociological Study.

Business Meeting—Election of Officers, &c.

The Session has been most successful, for not only have there been twice as many meetings as in previous Sessions, but those meetings also have been better attended than formerly, and the various Lectures that have been given have been of such a character as is well calculated to further the objects of the Association. On one occasion, a professional Lecturer, (Mr. Proctor), was engaged, and to his Lecture members of neighbouring Societies were invited, and twenty-five from Maryport and Cockermouth attended.

The Association numbers seventy-six members, which is an increase upon last year's membership; and the financial position also is very satisfactory.

MARYPORT LITERARY AND SCIENTIFIC SOCIETY.

SESSION 1876—1877.

President	Rev. A. Oates.
Vice-President	Mr. J. Wood.
Secretary	Mr. J. B. Bailey.
Treasurer	Mr. J. Robinson.

Committee.

Dr. Crerar. | Rev. J. Cochrane.
Mr. W. Hine. | Mr. J. Hodgson.
Mr. J. Adair.

MEETINGS were held during the Session, as follows :—

ORDINARY MEETINGS.

Held in the George Street School-room.

Oct. 27.—Rev. J. Cochrane—Criticisms.
Nov. 17.—Mr. R. Adair—Love, Courtship, Marriage.

Dec. 15.—Mr. J. B. Bailey—The Flame of a Candle.
Dec. 20.—Mr. J. Hodgson—The Creation.
Jan. 26.—Mr. H. Conley—Winds.
Feb. 2.—Mr. A. Noble, F.C.S.—Water.
Feb. 23.—Mr. J. H. Goudie—Charles Lamb.
March 23.—Rev. J. S. Craig—The Ancient Icelander: His Life and Literature.
April 27.—Mr. J. B. Bailey—Shakespeare.

LECTURES.

Nov. 3.—J. Clifton Ward, Esq., F.G.S.—The Old Glaciers of Cumberland.
Dec. 1.—R. Russell, Esq., C.E., F.G.S.—Coal, and its formation.
Jan. 12.—Jas. Gordon, Esq.—History of the English Language.
Feb. 9.—Rev. W. Williams, F.G.S.—Some of the Laws of Thought.
Mar. 9.—Rev. J. J. Thornley, M.A.—The Alphabet.
Apl. 6.—J. D. Kendall, Esq., C.E., F.G.S.—The Theory of Evolution.

The Committee of the Maryport Literary and Scientific Society in presenting this, their first Annual Report, have great pleasure in drawing attention to the steady and regular increase in the number of members.

At a preliminary meeting held on September 25th, J. Clifton Ward, Esq., delivered an able address on the objects and working of Literary and Scientific Societies; after which twenty-five members were enrolled, whilst at the close of the Session there were seventy-one on the books.

The programme was successfully carried out, and the discussions at the end of each meeting fairly well upheld. The ordinary meetings were for members only. To the lectures the public were admitted on payment of a small sum. The attendance at the meetings has been of a very encouraging nature.

Financially too, the Society is in a flourishing condition, having a balance of nearly £6 in hand.

NOTES ON THE METEOROLOGY OF COCKERMOUTH.

By Henry Dodgson, Esq., M.D., F.R.A.S., (Cockermouth).

This paper comprises a summary of Meteorological observations taken at Cockermouth during the fifteen years, from January 1862, to December 1876.

The instruments observed were the barometer, wet and dry-bulb thermometers, together with self-registering thermometers for recording the maximum and minimum temperatures both in the shade and on the grass. The rain-fall was also noted, as well as the amount of cloud and of ozone; and the direction of the wind with its apparent force recorded.

All the observations were made twice a day—at 9 a.m., and 9 p.m., —except that the rain-fall was in general only measured once a day—at 9 in the morning.

Barometer.

In giving a summary of the readings of the Barometer, there is nothing very noteworthy to record, since the atmospheric pressure is pretty uniform over the British Isles: there being a small but gradual diminution of pressure from south to north.

The mean annual height for this latitude is about 29·9 inches; and my own observations agree very well with this, the mean I obtained for the 15 years being 29·876 inches.

In the first table I have given the mean pressure for each year of the series together with the highest and lowest observed during that year.

It is very common for persons who are in the daily habit of observing the Barometer as a "weather glass," but without keeping any record

of its readings, to remark, after any unusual rise or fall in the mercurial column, that they never before saw "the glass" so high, or so low, as the case may be. It is therefore, perhaps, worthy of note, that the highest reading in the 15 years occured on the 6th March, 1874, and was 30.834 inches; and the lowest on the 19th January, 1873, when it was 28.176 inches; the range for the period thus being 2·658 inches (a little over 2½ inches).

Comparing one year with another, the greatest difference in mean pressure occured on two consecutive years, 1871 and 1872, when there was an average of rather more than ¼ inch between them (·274 inch) These two years were also, as will be seen, remarkable in another respect, as being the driest and the wettest years of the period of observation.

I may add for the information of any one who may wish to compare my results with his own, that all the readings have been corrected for index error, capillarity and temperature, and reduced to the mean sea level.

Table I.

BAROMETRIC SUMMARIES.

Year	Mean Pressure	Highest Reading	Date of Highest	Lowest	Date of Lowest
	Inches	Inches		Inches	
1862	29·851	30·725	Feby. 9	28·308	Oct. 19
1863	29·873	30·679	Feby. 13	28·699	Sep. 22
1864	29·910	30·751	Novr. 6	28·621	Nov. 18
1865	29·895	30·766	Decr. 11	28·311	Jany. 14
1866	29·793	30·569	Jany. 25	28·669	March 24
1867	29·911	30·819	March 3	28·527	Jany. 8
1868	29·878	30·705	Nov. 13	28·469	Dec. 27
1869	29·894	30·544	Dec. 6	28·633	Dec. 13
1870	29·932	30·683	Dec. 1	28·488	Oct. 23
1871	29·993	30·585	March 28	28·529	Jany. 16
1872	29·719	30·451	April 6	28·397	Jany. 18
1873	29·855	30·712	Feby. 18	28·176	Jany. 19
1874	29·886	30·834	March 6	28·651	Nov. 29
1875	29·933	30·674	March 17	28·771	Jany. 24
1876	29·816	30·602	May 9	28·377	Dec. 4

Wind.

The few remarks that I have to make about the wind may be stated here, since the Barometric readings are more affected by currents of air (or wind) than by any other cause.

Cockermouth being placed in a valley, is not well situated for observations on the wind. It is too much sheltered from it. For some time I attempted to record both the speed and pressure of the wind, but soon came to the conclusion that the readings were too low; although my gauges, consisting of Robinson's anemometer, and Lind's wind gauge, were placed on the top of a barn. I therefore gave up observing the instruments, and contented myself with noting the direction and apparent force of the wind.

The prevailing air currents are from the S. & W., and these are both warmer and more moist than winds from the N. or E.

The greatest depressions of the barometer precede or accompany gales from the S.W. A heavy fall of rain causes much less depression than an impending high wind. I have generally observed gales to commence from the south, and then gradually veer round the west, and N.W. towards the close. This is common, I believe, in other parts of the kingdom, as the centre of most of these storms is somewhere in the north sea.

Thermometers.

In stating the results of the readings of the Thermometers, we will take first the temperature in the shade.

The instruments for recording this were placed at the height of four feet from the ground, in a stand which shaded them from the sun, and at the same time allowed them to be freely exposed to the air. The sides of the stand, which is quadrangular, is composed of a double framework of louvre boards on three sides. The north side, where the door is, being single. The top of the stand is also double, and the outer covering painted white, and quite open on all sides, so as to prevent any heat being communicated from the sun's rays to the instruments below.

Table II.

MEAN TEMPERATURES IN SHADE.

1862—1876.

Year	Jany.	Feb.	Mch.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Means
1862	39·2	41·8	41·7	46·6	53·2	53·9	55·2	57·7	54·9	49·8	38·0	44·5	48·0
1863	40·7	42·3	44·8	46·7	49·8	55·1	58·0	57·6	52·8	50·3	46·0	43·8	49·0
1864	37·2	35·2	41·0	48·8	53·7	54·0	58·8	56·1	54·5	48·9	43·3	40·6	47·6
1865	36·4	35·3	38·2	50·3	52·7	60·3	60·4	58·4	60·3	49·2	42·6	44·3	49·0
1866	42·1	39·7	39·6	47·3	50·2	58·9	59·8	58·3	53·7	51·0	44·5	43·5	49·05
1867	32·7	44·0	37·6	47·3	52·6	56·7	58·3	60·0	56·6	49·1	41·5	40·3	48·06
1868	39·1	43·3	44·4	47·5	54·7	57·7	63·2	62·0	57·2	47·6	41·5	44·6	50·2
1869	43·6	45·2	39·6	49·7	48·0	55·9	61·4	58·0	57·2	49·2	42·9	36·5	48·9
1870	38·3	38·0	41·0	48·7	51·8	57·0	61·8	60·8	55·6	48·7	39·7	33·7	47·9
1871	33·7	42·7	44·8	46·9	52·3	56·1	58·7	61·4	54·6	49·7	39·1	39·8	48·3
1872	41·8	44·3	44·5	46·4	49·3	56·5	62·0	60·5	55.4	47·6	43·6	40·9	49·4
1873	41·2	35·2	42·8	46·6	49·7	57·6	60·2	58·9	53·4	47·2	42·6	44·5	48·3
1874	42·0	39·7	44·2	49·4	49·9	56·5	60·7	58·4	55·5	50·1	43·1	30·3	48·3
1875	43·5	37·2	41·0	46·9	52·9	56·0	59·1	60·4	58·4	48·8	41·0	39·2	48·7
1876	40·4	40·0	39·7	45·8	49·8	56·5	60·3	59·8	54·2	51·8	41·9	43·8	48·6
Means	39°4	40·3	41·6	47·6	51·4	56·6	59·8	59·2	55·3	49·3	42·1	40·7	48·6
Nr London	38·3	40·0	42·2	46·6	52·3	57·8	61·0	60·0	57·6	50·8	43·6	39·8	
Greenwich	35·7	38·2	40·9	46·7	52·6	58·0	61·3	60·5	56·3	49·3	42·4	38·8	

Table II. gives the mean temperature for each separate month in the fifteen years, also the means for every year, and for each month, collectively. For the purpose of comparison, there is added under the mean temperature for each month similar means for the neighbourhood of London, and for the Royal Observatory, Greenwich. As there is considerable discrepancy between these two, I may state that I have taken the former from Mr. Glaisher's "Tables of Corrections to be applied to Meteorological Instruments," (1850); and the latter from Drew's "Practical Meterology," (second edition, 1860). It will be observed that the summer months, May, June, July, and August, have a higher mean temperature assigned to them on the authority of Drew, than on that of Mr. Glaisher, whilst the remaining eight months are much lower.

I cannot determine which of these two is the more reliable, but whichever is correct, the result of the comparison is the same in *kind*, although it differs in DEGREE, viz:—that the mean temperature of the winter months is higher, whilst that of the summer is lower at Cocker-

mouth, than in the neighbourhood of London: that is, we have a milder winter, with a cooler summer.

[Since the above was written I have ascertained the average mean temperature at Greenwich for the past 105 years (from Mr. Glaisher's remarks on the weather published in the Registrar General's Quarterly Returns of Marriages, Births, and Deaths,) viz.—

January	36·5°	April	46·0°	July	61·6°	October	49·6°
February	38·6°	May	52·8°	Aug.	60·8°	Novr.	42·3°
March	41·1°	June	58·2°	Sept.	56·6°	Decr.	39·1°

It is noteworthy that the mean temperature for each month, except May, was higher during the last thirty-five than in the previous seventy years of this period, at Greenwich.]

These results, as regards the winter months, may surprise those who have not paid much attention to climatology, but they are quite in accordance with ascertained facts. It is well known that whilst the isothermal lines, (or lines of equal temperature) in summer cross the British Isles from East to West, in winter their direction is from south to north. In other words, in summer the mean temperature increases from north to south; whilst in winter the increase is in a direction from east to west; so that the former of these facts account for the lower summer temperature here in the north, whilst the longitude of Cockermouth, west of Greenwich, (about 3° 23′) may in like manner account for the warmer winter months.

Very possibly, however, the means obtained for the fifteen years of observation may have to be modified by a more extended series, as there are known to be cycles of hot and cold years, in periods varying from nine to fifteen years; but these results agree very well with the isotherms which Mr. Buchan gives on outline charts of the British Isles, in his handbook of Meteorology. In the month of January, the isothermal line of 39° is there represented as skirting the west coast, and passing through Cumberland, to the east of Cockermouth. Whilst for July, the isothermal lines of 59° and 60°, cross the former to the north of Cumberland, and the latter to the south of it, or about the mouth of the Duddon.

Range of Temperature.

The mean temperature, if taken alone, is not a safe guide to climate; for two stations may be identical as to their mean temperature, and yet the climate be very different. It is for this reason I have constructed Table III., giving the extremes of heat and cold during the period over which the observations have extended.

Table III.

EXTREMES OF TEMPERATURE.

	Highest Temperature in Shade	Date of Highest	Lowest Temperature in Shade	Date of Lowest	Highest in Sun	Lowest on Grass
	°		°		°	°
1862	74·7	April 30	19·0	March 3		
1863	77·0	July 11	25·4	Mch. 18		
1864	82·5	May 19	14·4	Jany. 6	124·0 May	6·9 Jany.
1865	81·3	June 18 Sep. 15	9·5	Feb. 15	129·8 June	6·7 Feb.
1866	83·4	June 29	16·8	Jan. 12	134·8 June	10·6 Jan.
1867	84·9	Aug. 13	7·4	Jan. 14	139·8 July	0·4 Jan.
1868	89·3	Aug. 4	22·1	Jan. 10	146·5 Aug.	9·1 Nov.
1869	86·9	Aug. 27	4·9	Dec. 28	135·7 July	−3·0 Dec.
1870	89·4	July 25	12·4	Dec. 23	136·0 Aug.	5·0 Dec.
1871	80·3	Aug. 30	10·5	Jan. 12	137·0 June	5·2° Jan.
1872	84·1	July 26	21·2	Dec. 12	127·5 July	10·2° Dec.
1873	89·1	July 22	11·5	Feb. 24	137·0 July	4·0 Feb.
1874	81·6	July 18	12·1	Dec. 29	134·0 July	12·1 Dec.
1875	78·4	Sep. 13	19·6	Dec. 5	133·2 July	11·8 Jan.
1876	88·3	Aug. 13	16·8	Jan. 9	130·4 July	11·0 Nov.

The IVth Table gives the range of temperature in each month, also the mean daily range, and the greatest range that occured in any one day.

Table IV.

A TABLE OF THE RANGE OF TEMPERATURE.

		Jan.	Feb.	Mch.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
		°	°	°	°	°	°	°	°	°	°	°	°
	Mean daily range	7·8	10·2	12·5	14·3	13·8	10·2	11·1	12·3	17·5	13·5	11·6	7·3
1862	Greatest daily range	17·9	20·8	27·2	32·8	26·9	24·4	19·6	22·1	30·8	25·1	18·4	14·6
	Monthly range ..	30·6	41·0	39·5	51·0	35·0	24·7	20·8	24·5	36·7	34·0	38·4	28·4
	Mean daily range	6.2	9·3	11·3	13·4	13·3	12·9	18·5	13·7	10·0	11·0	10·5	8·2
1863	Greatest daily range	11·6	24·3	20·9	25·7	26·8	26·6	26·8	22·8	21·5	22·5	24·1	21·1
	Monthly range ..	22·0	27·4	36·6	27·7	30·1	30·9	38·6	34·2	25·5	31·4	33·8	25·1
	Mean daily range	9·7	11·8	12·3	16·4	17·5	13·1	16·4	17·8	13·3	13·6	10·1	7·7
1864	Greatest daily range	19·3	21·3	25·0	27·6	33·7	29·3	29·1	30·1	31·9	25·3	23·7	14·7
	Monthly range ...	35·1	31·8	36·3	39·8	46·0	33·0	36.3	42·3	31·9	32·5	26·2	28·9
	Mean daily range	9·3	11·0	11·4	18·7	13·1	18·5	15·3	14·8	15·8	15·2	12·0	8·7
1865	Greatest daily range	22·7	25·4	21·1	33·3	30·3	29·5	28·5	27·2	34·8	22·3	20·9	25·7
	Monthly range ...	33·7	38·4	29·7	40·7	39·4	35·3	31·4	29·6	41·9	45·4	30·8	31·6
	Mean daily range	7·7	9·5	12·6	14·7	20·2	15·5	15·1	12·8	12·0	13·7	9·2	9·1
1866	Greatest daily range	25·1	19·5	22·2	31·6	36·9	31·4	30·1	24·5	23·7	27·3	21·7	19·6
	Monthly range ...	35·1	28·2	35·6	44·9	44·5	43·8	38·2	37·4	29·9	37·9	33·1	25·7
	Mean daily range	12·4	8·8	12·0	9·9	15·5	15·5	15·9	13·4	10·9	10·8	10·7	9·2
1867	Greatest daily range	24·4	21·2	25·8	25·5	28·1	29·5	28·6	32·3	24·9	20·5	19·7	20·0
	Monthly range ...	45·4	30·1	37·3	25·5	45·8	33·3	40·0	43·4	35·8	30·7	30·3	30·6
	Mean daily range	8·9	7·4	10·7	15·6	14·9	14·6	20·2	13·9	15·9	13·6	9·6	7·5
1868	Greatest daily range	16·8	19·3	23·2	27·7	26·3	34·8	34·1	32·1	27·6	28·1	20·4	16·3
	Monthly range ...	30·4	26·5	29·9	34·9	38·7	40·8	43·0	46·3	46·7	33·7	34·5	27·0
	Mean daily range	8·7	8·4	13·1	17·8	15·4	16·6	15·8	18·7	11·2	13·2	9·6	11·7
1869	Greatest daily range	18·3	17·1	21·2	33·5	37·0	25·6	33·8	41·0	28·7	24·2	23·6	29·8
	Monthly range ..	26·3	28·8	25·3	44·5	37·5	38·9	36·9	53·8	35·4	45·7	32·1	47·6
	Mean daily range	9·4	10·6	13·7	17·0	15·1	13·9	17·0	22·8	16·1	13·4	12·0	10·0
1870	Greatest daily range	24·6	18·8	22·2	37·1	29·6	29·0	39·2	32·3	29·1	36·5	20·4	20·4
	Monthly range ...	30·5	28·5	30·2	47·1	43·0	35·8	42·0	47·0	34·8	39·8	30·2	41·2
	Mean daily range	10·1	8·1	15·4	14·1	19·4	19·2	13·1	16·8	15·8	14·1	12·0	8·4
1871	Greatest daily range	23·3	16·0	38·4	29·0	30·5	29·9	24·1	30·1	28·8	31·9	23·3	19·3
	Monthly range ...	37·3	32·0	48·7	33·6	49·9	39·3	27·9	37·2	45·0	37·3	33·0	34·0
	Mean daily range	8·2	9·6	11·8	13·7	13·9	14·3	15·6	16·9	12·3	12·6	9·3	8·1
1872	Greatest daily range	18·9	24·1	23·8	23·1	24·4	28·8	30·8	31·4	25·1	27 4	22·4	21·6
	Monthly range ...	28·9	24·1	40·7	33·3	29·8	41·6	42·7	42·3	45·9	29·4	31·7	33·6
	Mean daily range	8·7	11·2	14·2	18·7	17·0	17·6	13·8	12·3	15·1	11·7	9·8	6·6
1873	Greatest daily range	21·9	27·5	28·3	38·5	31·1	32·0	26·1	22·8	31·5	24·2	20·6	18·6
	Monthly range ...	29·6	36·1	41·8	42·8	38·0	32·1	42·4	32·7	40·1	40·3	31·9	30·0
	Mean daily range	6·6	11·2	11·8	16·2	16·2	18·7	18·1	12·7	11·3	10·8	8·7	11·1
1874	Greatest daily range	20·1	21·5	25·9	27·7	28·7	29·3	28·0	23·1	23·0	21·5	18·7	22·6
	Monthly range ..	20·2	28·9	36·7	44·1	33·7	41·2	37·4	31·8	28·8	32·8	27·4	36·9
	Mean daily range	8·8	8·3	11·9	17·4	15·5	14·9	17·0	13·5	13·9	9·6	8·6	7·1
1875	Greatest daily range	18·2	15·4	25·1	31·9	29·7	32·9	30·1	24·0	29·9	21·1	18·5	16·2
	Monthly range ...	34·1	26·7	29·9	39·1	34·6	33·2	37·3	28·1	38·5	34·5	31·0	32·4
	Mean daily range	8·8	8·5	10·5	12·7	18·7	17·0	15·8	17·0	13·2	9·5	10·5	5·0
1876	Greatest daily range	18·9	18·4	19·0	27·5	28·3	32·4	35·2	38·8	22·9	20·8	19·7	20·3
	Monthly range ...	34·5	30·7	29·4	40·0	41·1	45·5	40·8	44·7	36·7	43·6	36·4	23·6

Table V.

LOWEST TEMPERATURES IN APRIL, MAY, AND JUNE, IN SHADE AND ON THE GRASS.

	1862		1863		1864		1865		1866		1867		1868		1869	
	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass
	°		°	°	°	°	°	°	°	°	°	°	°	°	°	°
April ...	23·7 12th		32·9 24th	25·4 24th	34·0 17th	22·0 13th	34·0 30th	22·3 30th	27·6 30th	21·0 30th	34·8 29th	25·0 29th	27·3 11th	19·4 11th	29·0 1st	23·5 1st
	°		°	°	°	°	°	°	°	°	°	°	°	°	°	°
May ...	36·0 3rd		35·8 8th	28·8 22nd	36·5 27th	25·4 8th	40·2 13th	32·8 1 & 8	31·0 3rd	22·4 3rd	29·6 23rd	21·6 23rd	33·2 6th	24·2 6th	32·0 29th	23·2 9th
	°		°	°	°	°	°	°	°	°	°	°	°	°	°	°
June ...	40.9 10th		39·2 12th	33·5 12th	34·2 2nd	26·3 2nd	46·0 4th	33·8 12th	39·6 19th	31·0 18th	42·7 8th	36·4 8 & 21	41·4 18th	35·7 18, 20	38·4 10th	31·0 1st

	1870		1871		1872		1873		1874		1875		1876	
	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass	In Shade	On Grass
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
April ...	27·8 3rd	20·5 5th	29·7 8th	18·7 8th	31·0 20th	21·3 6 & 19	26·6 23rd	14·7 24th	32·1 13th	22·0 15th	30·4 14th	24·6 26th	25·0 13th	12·7 13th
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
May ...	30·8 4th	21·4 3rd	28·8 17th	22·3 17th	33·8 18th	21·9 18th	30·7 19th	16·9 19th	31·2 10th	23·0 17th	36·6 30th	29·2 17th	27·3 2nd	18·8 2nd
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
June ...	43·0 23rd	35·9 23rd	34·6 3rd	26·6 5th	38·7 7th	30·2 7th	40·3 2nd	33·7 16th	34·1 12th	26·6 12th	39·8 1st	33·3 1st	37·7 1st	28·2 1st

The mean daily range varies from 8·4° in December, to nearly 16° in May, June, and July. The greatest range observed in any one month was 53·8° in August, 1869; and the greatest range in twenty-four hours was 41·0° also in August, 1869, (from 45·9° to 86·9°).

The occurence of low night temperatures in the spring months is of much importance to the agriculturalist, from the injurious effects they have upon young and tender vegetation of all kinds.

From Table V., it will be seen that the thermometer in the shade was at or below the freezing point in ten years out of fifteen in April, and in nine years of the fifteen in May, and 32.1° in another year.

It has never been observed so low as 32° at night in June, in the shade at four feet above the ground; but on June 2nd, 1864, it registered 34·2°, and on June 12th, 1874, as low as 34·1° (only 2° and a fraction above it).

The thermometer on the grass has frequently been down to the freezing point in June. This has occurred in seven out of fifteen Junes; and of course this low temperature on the grass will act very injuriously on any low growing plant or germinating seed, although plants of a taller growth may escape its influence.

The highest summer temperatures recorded (in the shade) were :—

89·4° on July 25th, 1870.
89·3° on Aug. 4th, 1868.
89·1° on July 22nd, 1873.

Whilst the lowest in winter was 4·9°, on December 28th, 1869.

In the direct rays of the sun, the blackened bulb thermometer, in vacuo, registered 139·8 in July, 1867—this being the highest observed. Whilst in December, 1869, the minimum thermometer on the grass registered—3·0° (below zero).

These are the extremes of temperature that occurred during the fifteen years. But I believe that on the 24th December, 1860, a year before the systematic observations were commenced, the thermometer was down to, or even a little below zero, in the shade.

The extreme range of temperature in the shade, may therefore be assumed to be about 90°. It rarely occurs that the summer heat exceeds

85° in the shade, and when it does, a thunderstorm is the usual result, and this cools the atmosphere for a time.

The amount of Solar radiation in the summer months is from 30° to 50°. It is greater during June than July: the mean of the former month being 43·9°, and of the latter 42·0°. In August the mean falls to 36·3°.

By Solar radiation is meant the excess of temperature registered by a thermometer, with a blackened bulb, fully exposed to the sun's rays on the grass, above that recorded by an instrument in the shade. In like manner, a thermometer exposed on the grass at night usually reads much lower than a similar one in the shade, at four feet above the ground. The difference between the readings being greatest when the air is clear, and the sky free from clouds. Under such circumstances, there is generally a difference of 10° or 12°, or even more. This is called terrestrial radiation, and is shewn in Table III.

Ozone.

Except in the first month of 1862, a daily record of the amount of ozone in the atmosphere has been kept during the fifteen year period.

Some Meteorologists are so sceptical as to the value of the tests used for the detection of this agent, that they take no account of it. The test which I employ is Dr. Moffat's, or rather a modification of it; the test papers being prepared and sold by Messrs. Negretti and Zambra. I believe it is generally admitted that these papers may occasionally be affected by other gases than ozone, e. g. by free nitric or nitrous acid fumes, present in the atmosphere. However, I give my results for what they are worth.

The ozone scale is divided into ten parts, according to the degree of coloration: (I show you here the scale employed, from 0 up to 10): The strip of test paper is exposed to the air for twelve hours, and then compared with the chromatic scale. The mean degree of coloration imparted to it at Cockermouth was only 2·2. It was greatest in January, and smallest in June. Since the tint was also, in general, deeper by night than during the day, I am inclined to think that it was influenced

by light; for, although the test-paper was screened from the sun, it was exposed to diffused day-light, which, of course, is of longest duration in June. Some authorities recommend the papers to be kept in the dark during exposure. Ozone was observed to be most abundant during damp and windy weather, and least so, when the atmosphere was comparatively dry and calm. A south or S.W. wind always coloured the test-paper most deeply; and a polar current, or one from the N.E., seldom gave indication of the presence of much ozone. This may be one reason, I do not say the sole one, why Easterly winds are unhealthy; for ozone undoubtedly possesses great disinfecting properties; it is regarded by many as Nature's own disinfectant.

I may just contrast for a moment the small amount of ozone registered at Cockermouth, with the abundance of the same agent at Silloth, where it is present in such quantity that it has been found necessary to make an alteration in the scale for that place. The test-papers were so frequently coloured of a deeper tint than any on the scale, that the Rev. F. Redford has had it extended up to twenty, in place of ten. I believe that Silloth stands the highest of any known place in the kingdom as regards ozone.

Cloud.

The amount of Cloud is estimated like ozone; the scale being from 0 when the sky is perfectly clear, up to 10 when it is entirely covered with cloud. The mean amount during the year was estimated at 6·2; this is probably a little too low, since at Greenwich the mean is 6·7.

The West coast of Scotland has also a similar mean; whilst in the interior, and on the east Coast of Scotland, the mean is only 6·0 according to Buchan's Meteorology. The smallest average amount of cloud was in the months of July and April, and the greatest in December and January.

Humidity.

The existence of cloud indicates a certain amount of moisture in the atmosphere. The degree of humidity is calculated from the difference between the readings of the dry and wet-bulb thermometers,

except when the air is fully saturated with moisture, the wet-bulb always reads lower than the dry-bulb. This varies from a fraction of a degree, up to twelve or fifteen degrees. If, as is generally done, we estimate the humidity from 0 up to 100, the former denoting absolutely dry air, and the latter complete saturation; the mean degree of Humidity was 80·5 during the years of observation, and the range of the months from 72 to 92. The driest atmosphere during any one month was in June, 1865, when rain fell on three days only, and the mean temperature of the month was 3·7° above the average. On May 24th, of the same year, immediately before a thunderstorm, the humidity fell to 45, there being a difference of 13½ degrees between the readings of the dry and wet-bulb thermometers, (78·4° and 64·9°). The dew point on that occasion was 22·8° lower than the air temperature.

Table VI.

SUMMARY OF RAIN-FALL.

1862—1876.

Years	Jany.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Totals
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	Inc.
1862	4·93	1·39	3·06	4·45	3·61	4·20	3·03	4·23	2·24	10·38	1·94	7·03	50·50
1863	7·48	3·45	1·38	3·50	3·69	5·14	1·48	3·94	7·97	6·09	6·38	4·14	54·64
1864	2·67	2·18	3·72	2·20	2·44	3·24	1·66	3·01	5·79	3·22	4·87	6·32	41·32
1865	3·48	3·39	2·57	0·56	6·31	0·70	2·80	3·51	1·90	3·41	4·22	4·93	37·78
1866	8·56	4·44	2·44	1·00	1·95	2·49	4·51	3·45	6·91	2·55	6·89	5·57	50·76
1867	4·29	3·32	1·54	4·72	1·59	1·60	3·37	3·67	5·05	4·31	1·01	3·88	38·35
1868	5·14	6·52	6.92	3·08	3·22	1·28	0·80	4·11	1·93	5·99	2·91	8·22	50·12
1869	5·35	6·63	0·84	2·69	2·05	1·66	1·81	1·80	7·55	3·97	6·17	5·78	46·30
1870	4·41	3·56	2·36	2·11	4·02	1·97	1·05	2·85	4·32	9·56	3·53	2·00	41·74
1871	3·97	3·52	2·95	2·50	0·97	1·74	2·92	3·32	2·23	3·80	2·65	6·32	36·89
1872	7·00	3·34	3·57	1·55	2·92	4·59	4·04	3·88	6·93	7·77	5·20	5·03	55·82
1873	8·48	0·65	3·16	0·46	1·82	2·92	4·42	5·23	1·61	7·01	2·62	2·46	40·84
1874	5·04	3·03	3·10	1·51	1·28	1·19	2·65	6·70	6·03	8·63	4·57	2·57	46·30
1875	4·79	1·35	1·33	1·51	2·53	3·54	3·11	3·34	5·38	3·31	3·44	3·39	37·02
1876	2·48	3·94	3·76	2·65	0·72	3·76	2·25	3·82	6·59	3·58	2·64	4·77	38·96
Means	5·20	3.38	2·85	2·30	2·61	2·67	2·66	3·79	4·69	5·57	3·93	4·82	44·49

RAIN-FALL.

From humidity there is a natural transition to rain fall. That for Cockermouth is, as might be anticipated, intermediate between the excessive fall in the mountain districts, and the smaller amount registered

on the comparatively flat district along the shores of the Solway Firth. The mean yearly fall, as may be seen from table VI., was 44·5 inches; but for the first eleven years of the period, the gauge was kept in a situation which appeared to have an undue amount of rain fall. For three other similar gauges placed apart from it, but within a radius of half-a-mile, did not collect so much rain by about six per cent.

The first gauge was placed in a somewhat sheltered garden, comparatively open to the S. and W., but having buildings to the E. and N. of it; this probably caused more rain to fall there than would have done, had it been more open.

On this account, I have thought it right in taking an average, to deduct six per cent. from the total fall in the first eleven years. When this is done, the mean annual rain-fall of Cockermouth is reduced to 42·14 inches. In order to compare this with what falls at other stations, I have extracted from Mr. G. J. Symon's annual vols. of "British Rain-fall" the means for the ten years, (1866—1875).

Seathwaite, Borrowdale, has for that period a mean rain fall of	145·06	inches.
Barrow House, (Derwent Water) ...	73·63	,,
Keswick, (Mr. Crosthwaite)	61·82	,,
Mirehouse, (Bassenthwaite)	52·20	,,
Whinfell Hall, (Lorton)	54·62	,,
Higham	45·73	,,

These are all near the mountains, and have a higher rain fall than Cockermouth, (which for the same period was 44·42 inches, uncorrected).

If we now take the rain fall for stations further away from the mountains, the fall is found to be much lower.

At Stainburn, (near Workington) it is ...	38·70	inches.
At Whitehaven, (Braystones)	39·48	,,
At Silloth	33·77	,,
At Carlisle, (Cemetery)	28·95	,,

Thus showing that there is a gradual decrease in the rain fall as we leave the mountains.

If, instead of placing a rain gauge on, or a few inches above the ground, it is fixed on the top of some elevated building, it will be found to collect considerably less rain—the amount decreasing as the elevation increases.

As an illustration of this law, I may state that for a few years a rain gauge was kept on a pinnacle of the tower of Christ Church, Cockermouth, about 100 feet above the ground. During the five years, 1866—1870, the mean annual fall collected there only amounted to 24·74 inches; whilst on the ground below it, it was 45.45 inches during the same period.

It is rather singular that two consecutive years should have been respectively the wettest and the driest during the period of observation. This, however, was the case, the year 1872 was the wettest, and the year preceding, (1871) the driest.

If we now examine the separate months, October will be found to be the wettest, and April the driest.

The heaviest falls of rain that occurred during any one month were in October, 1862, when 10·38 inches fell; and in October, 1870, the fall was 9·56. The least amount of rain was in April, 1873, 0·46, and in April, 1865, 0·56. In June, 1865, there were the fewest rainy days of any month in the series, viz: three days only; the total fall during that month being 0·70 inches.

Taking now the daily falls which were remarkable, we find that the heaviest falls in 24 hours were:—

Sept. 27th, 1863,	when there fell	in	that time	2.177 inches.
Nov. 15th, 1866,	,,	,,	1.955	,,
Nov. 13th, 1869,	,,	,,	1.590	,,
Oct. 8th, 1870	,,	,,	1.800	,,
Oct. 29th, 1872	,,	,,	1.600	,,
Oct. 6th, 1874	,,	,,	2.140	,,

In November, 1866, also November, 1869, and October, 1874, there were floods in consequence of the heavy rain; the last of these being the highest since November, 1861. There was no flood during 1875; a year remarkable for floods in other districts.

The rain-fall was occassionally measured at shorter intervals than 24 hours, when it was excessive in amount. Thus, 1·82 inches of the heavy rain-fall of September 27th, 1863, was collected in 12 hours. On September 20th, 1866, 1.24 inches fell in 12 hours. On October 6th, 1874, there fell also in 12 hours 1.89 inches. During a thunder-storm on May 20th, 1865, there fell 0.55 inches in twenty minutes.

The average number of rainy days during the year is (for 15 years) 185, or rather more than every other day. By a rainy day is meant a day on which not less than $\frac{1}{100}$ of an inch of rain is collected. In the year 1871 there were only 167 wet days, whilst in 1872 there were 209. These were the two extreme years both as to amount and frequency of rain fall.

Evaporation.

It would be very interesting to be able to say how much of the rain which falls in our neighbourhood passes off by evaporation, and how much percolates through the soil or flows off in streams and rivers.

I made some attempt to ascertain the first of these points, but without much success, owing chiefly to want of time to devote to it.

The usual form of Evaporating Gauge, or "Evapometer," is a circular shallow metallic vessel. Into this a known quantity of water is placed, and the whole is kept freely exposed to the air.

It is evident that in summer, the water contained in a vessel of this kind will become unduly heated by the rays of the sun, and consequently too great an amount of evaporation will take place from it: a metallic vessel being a much better conductor of heat than any kind of soil.

Isaac Fletcher, Esq., F.R.S., of Tarn Bank, has published in "British Rainfall, 1869," p. 39, the result of his experiments on evaporation, carried on for six years, in a copper vessel; from which it appears that the evaporation exceeds the rain-fall. This may be quite correct under the given conditions, but it cannot be of any practical or scientific value as a guide to the amount of evaporation that goes on from the surface of the soil or of water.

In my attempts to elucidate this matter, I adopted a suggestion of Mr. G. J. Symons, and endeavoured to ascertain the evaporation which

takes place from the surface of a considerable body of water. A polished slate tank 3ft. by 2ft., and 1½ft. deep, was fixed in one of the filter-beds of the Cockermouth Water Works, where it was partly immersed in water which was being constantly renewed. The filter-beds are supplied by a self-acting valve from a storage reservoir, and after percolating through the gravel the water passes into another reservoir. This appeared so admirably adapted for the end in view, that I was very sorry to be obliged to relinquish the experiment before obtaining any good results.

The observations were extended over part of three years, with occasional interruptions from various causes, so that I cannot give accurate figures; but I believe the annual amount of evaporation under the conditions named to be about 21 or 22 inches, *i. e.* about one half of the rain-fall.

THE RAIN-FALL OF KESWICK.

By J. F. Crosthwaite, (Keswick).

One of the earliest notices of British rain-fall is contained in Dr. Dalton's book on Meteorology which was published in the year 1793. Dr. Dalton was then residing at Kendal. In 1788, he commenced his observations at Kendal, and Mr. Peter Crosthwaite did the same at Keswick, each over a period of five years, ending in 1792. The following table gives the mean annual quantity of rain—

At Kendal	...	...	...	64·50 Inches.
At Keswick	...	...	...	68·54 „
At London	...	...	...	17·63 „

Year	AT KENDAL		AT KESWICK		AT LONDON
	Inches of Rain	Wet Days	Inches of Rain	Wet Days	Inches of Rain
			9 MONTHS		
1788	39·25	193	34·30	152	14·89
1789	60·83	244	72·24	276	12·97
1790	62·36	203	64·74	225	16·05
1791	66·20	219	73·55	241	
1792	84·98	233	84·60	238	
Mean Annual Quantity of Rain for the Five Years.					
	64·50	217	68·54	241	

The next series of observations made at Keswick were by Mr. Jonathan Otley, from 1842 to 1851. From the following table it will be seen that the average of ten years was 57·162 inches. In the year 1848 there was the largest quantity, being 66·407 inches; and in 1850 the smallest being 39·528 inches.

YEAR			INCHES
1842	...	...	40·110
1843	...	...	59·654
1844	...	...	40·629
1845	...	...	62·200
1846	...	...	67·678
1847	...	...	58·286
1848	...	...	66·407
1849	...	...	48·802
1850	...	...	39·528
1851	...	...	62·327
		10	571·621
Average of Ten Years			57·162

When Mr. Otley found it inconvenient to continue these observations, he requested me to accept his rain gauge, and to continue to make a note daily of the rain-fall, which I have done from 1852 up till now. In the year 1872 I cast up the result of twenty-one years observations, and found the average fall during that period was—Inches, 58.948.

The particulars are given below:—

YEAR			INCHES
1852	...	...	79·954
1853	...	...	50·499
1854	...	...	46·815
1855	...	...	37·400
1856	...	...	47·552
1857	...	...	48·885
1858	...	...	50·270
1859	...	...	66·883
1860	...	...	54·173
1861	...	...	74·417
1862	...	...	61·370
1863	...	...	71·542
1864	...	...	52·676

1865	...	...	49·184
1866	...	...	70·810
1867	...	...	52·137
1868	...	..	65·742
1869	...	...	72·001
1870	...	...	56·268
1871	...	...	46·180
1872	...	...	83·150
		21	1237·908

Average fall in Twenty-one Years 58·948 inches

1873	...	...	54·990	Average in 4 Years 56·880 inches
1874	...	...	67·030	
1875	...	...	50·990	
1876	...	...	54·510	
		25	1465·428	

Average in Twenty-five Years 58·613 inches

It will strike every one that the result of Mr. Peter Crosthwaite's observations shows a much higher average than Mr. Otley's, or my own. This was occasioned by the exceptional year 1792, when 84·60 inches fell at Keswick, and 84·98 at Kendal. This, coming within the short period of five years, unduly increased the average. During the ten years Mr. Otley's observations covered, there was no such exceptional year; consequently by his measurement the annual rain-fall of Keswick was 11·38 inches less than that recorded by Dr. Dalton. There can be no doubt that Keswick and Kendal being amongst the first places in Britain where any regular accounts were kept, and the rain-fall being so far in excess of the quantity recorded at London (17·63 inches) gave rise to the common belief that Keswick and Kendal are the two wettest places in Britain.

During the last twenty-five years, there have been two exceptional years, viz:—in 1872, when there fell 83·150 inches, being within one inch and a half of the highest recorded in 1792, just eighty years before.

The other excessive year was 1852, when 79·954 inches fell, being only four inches less than in 1872. But, there was this remarkable difference between the two years. In 1852, in the months of January, November, and December, we had 43·190 inches; whilst in 1872, in the same months, the fall was 34·920 inches; thus showing that with four inches *less* rain in the whole year of 1852, there were 8·27 inches more in the three rainiest months.

The smallest quantity which fell in any year within the twenty-five years, was in 1855, when it was 37·400 inches. There have been nine years above the average, viz:—1852, 1859, 1861, 1863, 1866, 1868, 1869, 1872, and 1874.

During the period when Mr. Otley made his observations, viz:—from 1842 to 1851, Dr. John Fletcher Miller, of Whitehaven, had rain gauges placed at many stations in the Lake country; he was the first person who attempted on a large scale, a system of mountain gauges, which, on his lamented decease, were taken up by Isaac Fletcher, Esq., M.P., of Tarn Bank, Cockermouth, and he still continues the observations. Dr. Miller's observations led him to the conclusion that "the quantity of rain increases from the valley upwards to an altitude of about two-hundred feet, at which it begins to diminish." He says—"the mountains increase in altitude with great regularity, and it is here the greatest depth of rain invariably is found; the difference in the annual quantity between places contiguous to each other in the same valley is often remarkably great. The amount increases rapidly as we recede from the sea, and towards the head of the valley the increment ratio is enormous."

"Loweswater, Buttermere, and Gatesgarth, are in the same line of valley, and are about two miles apart from each other, yet in 1848, Loweswater had received seventy-six inches; Buttermere, 98 inches; and Gatesgarth, 133½ inches of water. Here in a space of four miles, we have a difference of fifty-seven inches in twelve months, and in some years the proportional increase is still greater. The head of Eskdale receives one-fourth more rain than the middle of the valley, and a like difference obtains between two stations in the vale of Borrowdale about

a mile apart, (Seathwaite and Stonethwaite), while the deposit at Ennerdale lake, and a farm-house three miles westward, is as two to one nearly."

The same law is observable in the valleys of Derwentwater and Bassenthwaite. At the foot of Bassenthwaite, Mr. Hoskins registered in 1871, thirty-six inches; at the head of the lake, at Mirehouse, Mrs. Spedding had forty inches; at the Post-office, Keswick, I measured forty-six inches; at Barrow House, Mr. Langton, fifty-nine inches; and at Seathwaite, the head of Borrowdale, one hundred and fifteen inches were measured. This shows that the fall was nearly double at Seathwaite to that at Barrow, although only four miles distant, the difference being fifty-six inches, and nearly three times the quantity which fell at Keswick.

This was in a year below the average.

The contrast between the years 1871 and 1872 is very striking, as will be seen by the following instances of places in this immediate neighbourhood, viz :—

	1871. Inches.	1872. Inches.	Excess in 1872. Inches.
Mirehouse	40·12	70·62	30·50.
Keswick	46·18	83·15	36·97.
Deer Close	48·05	80·43	32·38.
Barrow House	59·10	94·87	35·77.
Watendlath	67·00	109·50	42·50.
Seathwaite Borrowdale	109·75	182·05	72·30.

I have before alluded to the general notion that Keswick is the rainiest place in Britain, and some affirm in the Lake district also. This, however, is contrary to the fact, but the close proximity of the metropolis of the lakes to Borrowdale, may have tended to fix this popular error. Mr. G. J. Symon's excellent annual book, entitled "British Rain-fall," shows that in 1871 Grasmere had twenty-six inches more than Keswick; that Ambleside had twenty-five; Lesketh Howe, 26; Kirkstone Pass, 52; Haweswater, 37; Patterdale, 32; Windermere, 14; and Bowness 13 inches more than we had.

But, lest it should be thought that a single year is hardly a fair

criterion, I have taken the average of six years from Mr. Symon's book, and find the result even more noticeable. I find Grasmere had twenty-eight inches; Ambleside, twenty-six; Haweswater, forty-three; Patterdale, twenty-eight; Windermere, seventeen; Wythburn, forty-three; Barrow House, twenty-eight; and Seathwaite eighty inches more than Keswick. Indeed, if any one will examine carefully the annual accounts to which I have referred, it will be found that the quantity is greatest at Scawfell and Sty Head, and the places in the line of showers coming from the south-west have the greatest fall. Thus, while Kendal and Keswick have about an equal quantity, the places intermediate have considerably more.

My own observations for twenty-five years, (including the two exceptional years of 1852 and 1872), give an average of 58·61 inches, this may fairly be accepted as the ascertained average rain-fall at Keswick.

NOTES ON SOME PECULIARITIES OF THE WEST CUMBERLAND COAL FIELD.

By R. F. Martin, M.A., (Whitehaven).

When the writer heard last year—at the joint meeting at Whitehaven—the very graphic paper which was read by Mr. Clifton Ward, upon the history of the formation of the Lake district, the following thought suggested itself:—

"The history of the hills as given in this paper, terminates with the era of the coal formation, since which time, Mr. Ward believes that the hills have never been beneath the ocean. What, then, has been the subsequent history of the Lake hills? Have they had their *ups and downs*, or stood sublimely in their place, and watched time after time the upheaval and submergence of the rest of England as from a lofty pinnacle?"

The answer to this question must be sought from the consideration of the land round about the lakes: and as on one side, (and on one only, so far as the writer is aware,) not only has the Geology of the country been accurately observed, but also the ground has been extensively worked over by our miners, it is natural that the first appeal should be made to it. The writer then purposes to point out briefly the data which West Cumberland (as known chiefly by her *mining population)* may afford for answering the question asked above; and he must premise that he can but point out now the questions which we should endeavour to answer—not himself supply the answers; in fact, he wishes if possible to elicit some information upon this subject, from those more conversant with the subject than he is himself, even before we are favoured with the Geological Map and Memoir for West Cumberland, in which these matters will no doubt all be made plain to us.

(a) First, then, there are ample proofs in West Cumberland of successive elevations and depressions, more or less extensive, since the time of the coal formation. The Lower New Red, the Magnesian Limestone, and the New Red Sandstone, are all known to be marine formations; and since the time of the formation of these strata, the whole district has been faulted to an extraordinary extent by forces which must have produced large upheavals and depressions.

(b) A brief examination of the faults of West Cumberland will bring out some curious results. The whole district is faulted to an extent which is certainly without a parallel in coal-fields with which the writer is familiar. The faults also appear to arrange themselves in two distinct parallel systems—the one running about N.W. and S.E., the other about W.S.W. and E.N.E. This will be seen distinctly upon the map, where the two systems of faults as found in the coal-workings are shown in red. These faults are also remarkable for their sudden changes, not in magnetic direction, but in the amount of throw.

(c) The following questions will at once suggest themselves :—

1. Can any law or periodicity be made out from the directions and magnitude of these faults?
2. Has the direction of these faults anything to do with either the lines of level in the coal or the direction of the grain or cleat of the coal?
3. Can the main lines of fault be traced out upon the surface, by such natural features as the hills and valleys, the course of rivers, &c.
4. Has the direction or position of the lake hills anything to do with these systems of faults? Do they either converge to the hills, or swerve round as they get north or south of them? Do their directions correspond with lines of faulting in the hills, amidst the older lodes?
5. Is it possible by examining the intersections of the two systems, to infer which is the older of the two?

Now, without pretending to give any reply to these questions, the writer would wish to point out a few matters which seem to him material to forming an opinion upon them :—

1. Taking the main system of N.W. faults, the writer has counted faults *dipping* north to an extent of 330 fathoms, and *rising* north an amount of 510 fathoms. The average amount of throw for the faults is not far different in the two directions, viz. about 23 to 25 fathoms; but the result will place the north end of the field fully 180 fathoms above the south end *so far as this* system of faults has affected it.

Taking the other system of faults, there are throws *dipping* north to an amount of 280 fathoms, and *rising* north to an amount of 160 fathoms. Those throws which *dip north* have a preponderance of about 120 fathoms.

It will be readily understood that these figures are but very rough approximations; the larger faults only are taken in each case, and these vary so enormously in even short distances, that it is difficult to give anything more than a rough guess at the average value of each.

2. The question of cleat or grain in coal is one which has given rise to a great deal of discussion, and the writer will not hazard an opinion upon this point. It is, however, a fact that in a majority of instances the main N.W. system of faults appears to have determined the *level lines* in the coal, and consequently in the beds above and below the coal.

3. In the immediate neighbourhood of Whitehaven the valleys appear curiously to follow the lines of fault. The main valley in which the town lies is connected with the great 40 fathom dyke underneath the town, and the Aikbank valley just north of the town follows along the line of the 60 fathom "Davy Pit Dyke." Whether this be true of the rest of West Cumberland the writer hopes to hear this morning.

4. It is to be observed that the principal direction of most of the pockets of hematite in the Cleator district appears to conform in a curious way with that of one of these systems of faults, and also that the Lake Valleys themselves (and consequently the lakes) show the same tendency to arrange themselves along the same lines of direction.

5. The faults here referred to exhibit great variety of behaviour where they meet, but the general result appears to be that the N.W.

system is the oldest, and most general, the S.W. system the most recent and most marked and sudden system.

The writer would, in conclusion, ask one further question about these faults.

Can it in anyway be determined, by examining their peculiarities, by what kind of force they have been formed.

Now there are three ways in which faults may have been made.

1. By a force thrusting up a portion of the earth's crust.

2. By the interior of the earth cooling down and contracting, and so the surface falling in.

3. By an undulation of the surface of the earth such as is experienced in the case of the waves of earthquakes.

Now these three classes may be easily illustrated in diagrams, and it will be at once seen that the thrusting force is the one which corresponds with the general rule of the miners that a fault is nearer "back over."

If faults be produced by subsidence of surface then it must (in order to maintain this rule) be always accompanied by a corresponding elevation beyond.

And this may lead us to what must be at present a mere *conjecture* as to the origin of these systems of faults, viz.—

That West Cumberland has at different times been subject to two main *earth-waves*. The one running N.E. and S.W. (producing the N.W. system of faults) which was more general, gradual, and probably older, the other running about NN.W. and SS.E., which was more partial sudden and probably more modern: both however occurred after the formation of the New Red Sandstone Rock.

THE HEMATITE DEPOSITS OF CUMBERLAND AND LANCASHIRE.

By J. D. Kendall, C.E., F.G.S., (Whitehaven).

*(Abstract.)**

The writer after briefly noticing some of the principal facts which have been brought to light in working these deposits (those in the Carb. Lime.) went on to show that none of the explanations hitherto offered as to the manner in which the deposits originated could be considered at all satisfactory, and then proposed that it is only on the assumption of a Chemical replacement process that all the facts at present known can be explained. The facts on which he principally rests that hypothesis are the occurrence in the hematite of fossils similar to those found in the Carboniferous limestone, and the existence of thin bands of shale which run completely through the ore and into the limestone.

* The Author reserves the full details of this paper for the present.

THE RAISED BEACH ON THE CUMBERLAND COAST BETWEEN WHITEHAVEN AND BOWNESS.

R. Russell, C.E., F.G.S., (Whitehaven,) and T. V. Holmes, F.G.S.

(Abstract.)

The authors pointed out that an old sea beach could be traced, almost continuously between Workington and Bowness, thus indicating an elevation of the Cumberland coast corresponding to that which had been shown by Mr. Milne Holme and others, to have occurred on the Scotch coast. South of Workington the raised beach was not so well defined, but sufficient traces of it remained to show that the elevation had taken place along the whole coast.

A typical example of this ancient sea beach occurred between Workington and Flimby. From the shingle of the existing beach a broad flat was seen to stretch away inland for about 40 chains, and terminated at the base of the cliff, on which stands the ruins of the Burrow Walls. Near the existing beach this flat is about 25ft. above the mean sea level, but gradually rises to about 40ft. at the base of the inland cliff. When looked at from above, the ground lying at the foot of this cliff presents an apparently smooth and even surface, but a closer examination reveals the existence of a number of ridges running parallel to the present coast line and also nearly parallel to each other. These ridges consist of sand and gravel, covered with occasional patches of blown sand, and give to the surface that peculiar appearance which is so characteristic of shore deposits.

On the existing beach, especially that portion of it between the highest spring, and the highest neap tides, similar ridges of shingle and gravel are found at several different heights. Each of these gravel

ridges indicates the height to which the tide rose on each of the intermediate days between the two periods above mentioned. The tendency of the tidal action is to throw up the highest ridge on the inland side, because the shingle or gravel, accumulated on each occasion when spring tides occur, is not so liable to be removed as are the ridges thrown up at the heights to which the ordinary tides flow. There is a very great similarity between the shape and mode of occurrence of these gravel ridges, now being formed, and those which are found lying further inland, therefore, the authors conclude that the latter were formed by the flow and ebb of the tides when the land stood at a lower elevation than it does at present, and in a manner exactly similar to that in which the former are now being deposited and arranged.

South of Workington an alluvial plain extends from Workington Harbour to the Moss Bay Iron and Steel Works, the mean height of which above the sea level corresponds to that of the raised beach north of the harbour. The raised beach can also be traced for a short distance along the outside of the ridge at Chapel Hill; indications of it remain at Harrington; and the village of Parton stands on a portion of it. A considerable portion of the valley between Whitehaven and St. Bees is also not more than 40ft. above the sea level.

Northwards from Workington the raised beach stretches almost continuously to Silloth. Between Silloth and Grune Point a gravel ridge extends along the coast, on the east of which lies an extensive loamy plain, dotted here and there with a few patches of clean sand and gravel, the general level of the latter being some 4ft. or 5ft. below that of the former. Crossing Moricambe Bay a similar ridge runs through Cardurnock and Herd Hill to a point just west of the Solway Viaduct, and as on the southwest side of the bay, so here again the gravel ridge slopes down to a mossy flat a few feet below it.

The general elevation of the greater portion of the raised beach is from 20ft. to 25ft., but it occasionally attains a height of 40ft. above the mean sea level. As already pointed out, there is, north of Workington, the old sea cliff, the base of which was washed by the tide when the land stood 40ft. below its present level, but there is no distinctive cliff to mark

a second elevation as a 25ft. beach would indicate. The elevation apparently took place very gradually until it reached 40ft.

The continuation of the Roman Wall to, or below, low water mark at Bowness; the fact, that when the land stood at a lower level of 25ft., a considerable portion of Burgh Marsh would be under water, (and if this had been the state of things when the Wall was constructed, instead of crossing the marsh in a straight line between Burgh and Drumburgh, it would have been carried further south, or have ended off at Drumburgh altogether); the positions of the Roman camps at Maryport and Moresby; and other sources of information, afford grounds for arriving at the conclusion that the elevation took place sometime prior to the Roman occupation of this country.

In conclusion, it was stated, that the latest movement on this coast, however, was probably one of depression. The existence at St. Bees, of the remains of an old forest lying between high and low water mark would seem to point to a submergence of a more recent date than the elevation of the raised beach. Whether this submergence, if a submergence actually occurred, was also of pre-Roman age, there is not, at present, sufficient evidence to show.

REMARKABLE BOULDERS OF THE KESWICK DISTRICT

By J. Clifton Ward, Assoc. R.S.M., &c., (Keswick.)

Boulders may be considered as remarkable under three heads. 1. As to their position with regard to the parent rock. 2. As to their size. 3. As to the manner in which they have been placed or perched in their present situation.

This subject has been already dealt with in some detail in my Memoir on "The Geology of the Northern Part of the English Lake District," and here I shall only state general results and principles in order to aid local observation.

1. POSITION WITH REGARD TO PARENT ROCK.

If the one-inch Geological Map of the Keswick District be examined it will be seen that its south-eastern half is occupied by rocks of the Volcanic Series, and its north-western by those of the Skiddaw Slate Series. Boulders of either can readily be detected when lying upon the other, from their dissimilar character. Now, what are the facts of distribution? Mainly these: not a single boulder belonging to the Skiddaw Slate Series is found upon the Volcanic Rocks to the south-east, while thousands of boulders of the latter series (the Volcanic) are found upon the area to the north-west, occupied by the Skiddaw Slate. Nor is this chiefly because the Skiddaw Slate Series generally consists of softer rocks than the Volcanic, for it contains within its area not only granite and hard metamorphic rocks surrounding it, but intrusions of massive Diorite and Dolerite, and considerable thicknesses of sandy and even gritty beds.

When this question of the transport of boulders is however regarded side by side with that of the land glaciation and the trend of the ice-

scratches, it is at once seen that these latter, taken with the direction of boulder distribution, clearly point to the old glaciers of the valleys draining northwards, having flowed to the north and north-west, and to their having stranded fragments of the Volcanic rocks on the flanks of the Skiddaw Slate Mountains.

If the small glacial model in the Museum* be examined, the following details of distribution will be further seen. The boulders of the Ennerdale and Buttermere syenitic rock have been carried down the Lorton Vale in great abundance and over the low fells between Lowes water and Lorton. Boulders of the Armboth Dyke may be traced down the Thirlmere, Naddle, and St. John's Vales, and then mainly to the west towards Bassenthwaite, but *none have been found on the west side* of the Keswick Vale or Bassenthwaite ; they occur here and there nearly to the summit of Bleaberry Fell (at 1800 feet), and upon the top of Latrigg (1200 feet).

Boulders of the St. John's Quartz Felsite, situated on either side of the end of St. John's Vale, have been transported eastwards towards Mell Fell and Berrier in abundance, and westwards towards Bassenthwaite in smaller quantities, keeping on the north side of the valley.

Then, among rocks of the Skiddaw Slate area, we may note a stream of boulders proceeding from the Sinen Gill granite and surrounding metamorphic rocks, and passing down the Glenderaterra Valley (between Skiddaw and Blencathra) and then *principally* westwards, granite and spotted schist boulders being both found on the top and back of Latrigg and far down towards Bassenthwaite.

An interesting case of abnormal dispersion is that of boulders of the Sale Fell Minette (above and north of Wythop Vale) carried *southwards* across Wythop Moss on to the flanks of Kirk and Broom Fells.

2. BOULDERS REMARKABLE AS TO SIZE.

Two of the most note-worthy boulders, as to size, in the immediate district, are those of Volcanic Breccia and Conglomerate which we yesterday visited upon the flanks of Dodd, Skiddaw. Their dimensions

* Keswick Museum of Local Natural History.

are as follows :—Breccia boulder, in feet, 17 × 12 × 9; Conglomerate boulder, in feet, 18 × 14 × 8. This last is of special interest, moreover, inasmuch as the length of the boulder seems exactly to represent the thickness of the Conglomerate bed from which it has been derived, and the only one I know of in the district is at the northern end of High Rigg, west of the Chapel of St. John's in the Vale.

The Bowder Stone, I believe, is not a glacially transported boulder, but only a huge block fallen from the Crags behind, whence others are ready to follow.

A boulder of the Volcanic rocks on the hill slope just south of Matterdale Common, and at a height of over 1500 feet, measures in feet, 18 × 9 × 9, and there are many others of gigantic size.

Upon the Skiddaw Slate mountain flanks on the west side of Newland's Hause, boulders of Volcanic rocks occur, one of which measures in feet 6 × $4\frac{1}{2}$ × 3. In many places outside the mountain district there may be found boulders of gigantic size, such as the one near Bothel, but these would lead me too far from my present area.

3. BOULDERS REMARKABLE AS TO THE MANNER IN WHICH THEY HAVE BEEN PLACED OR PERCHED.

It is well known that retreating glaciers often leave boulders perched upon the rocks around in very extraordinary looking positions. There are not so many examples of this in our district as might have been expected when its extremely glaciated condition is considered; and I am inclined to think that the reason may be, that earthquake shocks have visited the area, since the close of the glacial period, sufficiently severe to topple over the more delicately poised blocks. The great fissuring of some of the mountain sides rather lends support to this view. There are, however, a few good cases of well-perched blocks, some of which may be mentioned. Upon Glaramara, at heights of 2000 feet are several examples of blocks nicely perched on ice-rounded rocks. On the west side of Thirlmere, there are two cases; one, a little south of Launchy Beck, is that of a large boulder standing upright on its smallest side, something after the manner of the Bowder Stone; and the

other may be seen from the high road on approaching Wythburn from Keswick, quite on the summit of the Fell above the upper end of Thirlmere, appearing as a rounded mass standing on a point in a top-like manner.

Over the fells south of Eskdale the well-perched boulders are perhaps more numerous than in many other parts, but time will not permit of the enumeration of a greater number of individual cases.

SUMMARY OF LESSONS TO BE LEARNT FROM THE DISTRIBUTION OF BOULDERS.

1. The boulder scattered country plainly tells the story of its recent glaciation, and the evidence gained from the study of the boulders is strongly confirmed by the system of ice-grooving and scratching so patent to the geological observer. We know of no other agency but that of ice which could give rise to the phenomena in question.

2. The distribution of the boulders tells us of ice acting in two ways: as land-ice, transporting them in the same general directions as those taken by the ice-groovings; and as floating-ice, carrying them sometimes against the general direction of the former land-ice and into positions into which no glacier system could have brought them.

Of this last fact it will be necessary to give a few examples.

There are several boulders of ash upon the southern slope of Lonscale Fell, just at and above the road-way, about 1200 feet above the sea-level, and there is one on the *north* side of the water shed between the valley of the Glenderaterra and that of the Caldew, at a height of 1300 feet. Now it seems quite out of the question to suppose that *land-ice* from the Borrowdale Mountains or Helvellyn range could ever have intruded itself among the recesses of Skiddaw and Blencathra, for these mountains would have supported large glaciers of their own and kept other ice at arm's length, therefore these boulders must have been transported by floating-ice, and the land must have been submerged to at least a depth of 1300 feet.

There are many other instances in which the present position of

boulders can be most readily explained by the action of floating ice; of such are the boulders of the Buttermere syenitic granite on the summit of Starling Dodd (2084 feet), and this and other cases support the idea that the submergence must even have reached to a limit of more than 2000 feet.

A group of boulders of minette from the small patch on Sale Fell, carried southwards on to Broom Fell, seems to prove that when the land stood at about 1200 feet lower than at present, a current swept the north-western outskirts of the district.

Thus, it will be seen, what interesting facts as to the history of the district may be learnt from the study of a boulder; it may tell us of a time when the land was glaciated much as parts of Greenland are at the present day, also of a time when this district was a group of icy islands, and may even reveal to us the direction of the currents in those ancient and ice-laden seas.

FLETCHER CHRISTIAN AND THE MUTINEERS OF THE "BOUNTY."

By William Fletcher, F.G.S., (Cockermouth.)

Many of you will not need to be reminded that in one of Sir Walter Scott's most charming novels—"Peveril of the Peak"—two of the leading characters are the brothers William and Edward Christian. They were both real, and prominent historical personages in the times of the Civil War, and as regards William, the part assigned to him by the novelist very much agrees with the actual facts of his life. He was Receiver-General of the Isle of Man, and used his influence to procure the surrender, to the Parliamentary party, of Peel Castle, which had been heroically held for the King by the famous Countess of Derby. For this transaction he was brought to trial twelve years afterwards, found guilty by a compliant jury, and condemned to death, and was executed on the 2nd of January, 1663. By the bulk of his fellow-Islanders he was looked upon as a martyr, and his memory was embalmed in Manx patriotic songs, one of which, entitled, "The heart-rending death of the fair-haired William," survives to this day. The Edward Christian of real life was not quite the detestable villain described by Sir Walter Scott; but, as the tool of Buckingham and the ally of the notorious Colonel Blood, he probably deserved the long imprisonment which ended in his death. The Christian family had been settled in the Isle of Man for many generations, and they held, as they have since continued to hold, the chief public offices in that little principality.

Towards the end of the seventeenth century, Ewan Christian, a nephew of William and Edward's, originated the connection of the family with

this county under circumstances which afford a curious illustration of the manners of the period. It seems the then Bishop of Sodor and Man was accustomed to beguile the monotony of his Episcopal duties by gambling, and one night the luck went so much against him, and in favour of Ewan Christian, that the latter was able to purchase with his winnings the estate and manor of Ewanrigg, near Maryport, which still remains the property of the family. Ewan was blessed with five sons and ten daughters. His successor, John, married a Senhouse, of Netherhall, and their eldest daughter, Mary, married Dr. Law, afterwards Bishop of Carlisle, and became the mother of the first Lord Ellenborough, who chose that title in consequence of his having been born at Ewanrigg Hall, which is close to the village of Ellenborough. John Christian's second son, John, who became his successor, married a Curwen, of Workington, and their son John, marrying his cousin, the heiress of the Curwens, took his wife's name, and, as John Christian Curwen, M.P. for Cumberland, acquired a fame which is not yet forgotten, both as a politician and as an agriculturist. John Christian's sixth son, Charles, was an attorney at Cockermouth, and married the grand-daughter of Jacob Fletcher, of Moorland Close, who was, like myself, descended from the William Fletcher who built Cockermouth Hall (now known as the old Hall), in the reign of Queen Elizabeth.

Charles Christian and his wife took up their residence under her paternal roof at Moorland Close, and there, according to the registers of Brigham Church, on the 25th of September, 1764, was born their sixth son, Fletcher Christian,—the ill-fated "Mutineer of the Bounty." Their fourth son, Edward, was brought up to the Bar, became professor of law at Cambridge and eventually rose to the dignity of Chief Justice of Ely. Besides editing a well-known edition of Blackstone's Commentaries, he was the author of numerous books on legal and social questions. One of these, which would have been of great interest to me in preparing this lecture, was called forth by the trial of some of the mutineers of the "Bounty," in 1792, but I regret to say I have not been able to meet with a copy anywhere, notwithstanding a careful search through the library

of the British Museum, and although the library contains upwards of twenty of Edward Christian's works.

Moorland Close, being within two miles of this town, is probably known to most of you as a quadrangular pile of buildings, in the style of the mediæval manor house, half castle and half farmstead, and those who have visited the field of Waterloo may have noted some points of resemblance between Moorland Close and the famous Château of Hougoumont. Few records have been preserved of Fletcher Christian's boyhood. He received his education, first at the parish school of Brigham, and afterwards at the Grammar School, Cockermouth. There was at one time at Moorland Close a painting of a piebald pony, upon which tradition said the boy Fletcher used to ride to and from school; and I understand that a sketch of the outline of his foot, which he had traced with his initials, may still be seen upon the lead roof of a summer house in the garden. One of Fletcher's schoolfellows at Cockermouth was Isaac Wilkinson, once a poet of some local celebrity. In after years the poet bore this testimony to the early character of the mutineer :—"I can with truth say, a more amiable youth I never met with; he was mild, generous, and sincere;" and Wilkinson repeated this testimony in the following verses :—

> "His soul was open, generous, and humane :
> His was a heart that felt for others' pain ;
> Yet quick of spirit as the electric beam
> When from the darkling clouds its lightnings gleam."

At an early age, Fletcher Christian entered the navy as a midshipman, and during his two last voyages in that capacity he served under Lieutenant Bligh, who was subsequently appointed to the command of "the Bounty," and commissioned by the Government to sail to Otaheite, for the purpose of transplanting bread-fruit trees thence to the West Indies. Although Fletcher Christian was then only 23 years of age, he was selected by his old commander, Lieutenant Bligh, to act as first mate, or lieutenant, of the "Bounty," which affords a strong proof that the young midshipman must have stood well in the service, both as to character and as to nautical ability. One of the midshipmen of the

"Bounty," Peter Heywood, also belonged to Cumberland, being a native of Whitehaven, and his name will often recur in my narrative. The boatswain's mate, was a man called James Morrison, who not only possessed uncommon powers of observation, but also considerable literary skill. Fortunately he turned his talents to account by keeping a diary, which survived all his vicissitudes, and a copy of which made by himself and extending to 382 pages of foolscap, has been kindly placed in my hands by Lady Belcher, the accomplished authoress of "The Mutineers of the Bounty," and a stepdaughter of Peter Heywood. It is to this diary that I shall be mainly indebted for my account of the mutiny, and of the fate of a portion of the mutineers.

Lieutenant Bligh had been for four years sailing master of Captain Cook's ship, the "Resolution," under the command of that distinguished navigator; and there is no doubt that he stood well both in Captain Cook's opinion and in that of his illustrious friend and comrade, Sir Joseph Banks. But there can also be no doubt that Bligh was a man of an irritable and overbearing temper, and that he maintained the discipline of his ship in the tyrannical and abusive fashion which was then too common in the British navy, and which, ten years later, led to the great mutiny of the fleet at the Nore. As Bligh acted as purser as well as commander of the "Bounty," and in that capacity had charge of the provisions, his opportunities for indulging the worse side of his nature towards the officers and crew were thereby greatly increased, and Morrison's diary shows that even before the ship set sail the foundation for future heart-burnings had been laid by Bligh's conduct as purser. The "Bounty" sailed from Spithead for Otaheite on the 27th of December, 1787. There is not time for me to follow the ship through all her adventures, and I will therefore only pick out such incidents from Morrison's graphic story of the voyage as particularly relate to Christian or bear upon the causes which led to the mutiny. He writes: "January 11, 1788. The ship's company were now put on three watches, and Mr Christian appointed to act as lieutenant by order of Lieutenant Bligh, which order was read to the ship's company by Mr. Bligh. The weather continuing fine, a few days later the cheese was got up to air, when on

opening the casks two cheeses were missed by Mr. Bligh, who declared they had been stolen. The cooper, however, declared that the casks had been opened before while the ship was in the river by Mr. Samuel's orders, and the cheeses sent to Mr. Bligh's own house. Mr. Bligh, without making any further enquiry into the matter, ordered the allowance of cheese to be stopped until the deficiency had been made good, and told the cooper he would give him a d——d good flogging if he said more about it. The order was strictly obeyed by Mr. Samuel, who was both clerk and steward, and next day butter was only issued. This the seamen refused, alleging that their acceptance of the butter without cheese would be a tacit acknowledgment of the supposed theft, and John Williams (a sailor) declared that he had carried the cheeses to Mr. Bligh's house, with a cask of vinegar and some other things. The crew persisted in their refusal of the butter for two more days, and then no more notice was taken of the matter." Later on Bligh ordered pumpkins to be served out instead of bread, at which the men grumbled; whereupon Bligh told them they were a lot of d——d infernal scoundrels, and that he would make them eat grass before he was done with them. Afterwards the officers took up this grievance and remonstrated with Bligh, who ordered all hands aft and told them "everything relating to the provisions was done by his orders, and it was therefore needless to complain, for they would get no redress. He added that he would flog the first man severely who dared to make another complaint." Further on Morrison records that the junior officers raised a complaint that all the pick of the provisions was devoured at the cabin table by Bligh and his messmates, the master and the surgeon. The result is not given; but as thieves fall out, so Bligh and these two messmates at last quarrelled, and during the rest of the voyage the latter sulked in their own cabins, and would not speak to Bligh when they could help it.

After a tedious passage, checkered apparently by many such troubles and also by a good deal of bad weather and of sickness, the "Bounty" anchored at Otaheite on the 25th of October, 1788. The winter was spent in collecting and storing bread-fruit plants, and as provisions were now plentiful and the natives treated their visitors with the utmost

hospitality and kindness, a better feeling seems to have prevailed for a while between Bligh and his officers and men. Amidst mutual regrets and many tender and sorrowful leave takings between the gallant tars (in a double sense) and their favourite Otaheitan beauties, the "Bounty" set sail for the West Indies on the 4th of April, 1789; but no sooner were the pleasures and excitements of the sojourn at Otaheite left behind than the old animosities broke out again on shipboard, and the conduct of Captain Bligh towards Christian seems to have become more insulting and brutal than ever. On one occasion whilst touching at the Friendly Islands, and without any apparent cause, Bligh, in a fit of passion, cursed Christian as a "cowardly rascal." This was language not likely to be forgiven by a young man of high spirit and ancient lineage. A few days subsequently the officers, and Christian in particular, had to endure a still worse outrage from their commander. As it proved to be "the last straw which broke the camel's back," I will give the incident in Morrison's own words (though it is needful to soften some of the adjectives) :—"April 27, 1789. This afternoon Mr Bligh came up, and taking a turn on the quarter deck he missed some of the cocoa nuts which had been piled up between the guns, and said they had been stolen. The officers were all called, and declared they had not seen a man touch them, to which Mr. Bligh replied, 'Then you must have taken them yourselves,' and questioned every officer in turn concerning the number he had bought. Mr. Christian's answer was, 'I do not know, sir, but I hope you don't think me so mean as to be guilty of stealing yours.' Bligh replied, 'Yes, you infernal hound, I do,' and then addressing the whole of the officers he added (with an oath which I cannot quote), 'You scoundrels, you are all thieves alike, and combine with the men to rob me. But I'll sweat you for it, you rascals, and make half of you jump overboard before we get through Endeavour Straits.' He then called Mr. Samuel and said, 'Stop these villains' grog, and give them only half a pound of yams to-morrow, and if they steal them, I'll reduce them to a quarter.' The cocoa nuts were carried off, and Mr. Bligh went below. The officers then got together, and were heard to murmur much at such treatment, and it was talked among the men that

the yams would be next seized, as Mr. Bligh knew they had purchased large quantities of them, and they set about secreting as many as they could."

Then follows the story of the mutiny—"On the morning of the 28th, the boatswain came to my hammock and waked me, telling me to my great surprise that the ship was taken by Mr. Christian. I hurried on deck and found it true, as Mr. Bligh had his hands tied behind him, and Mr. Christian was standing by him with a drawn bayonet in his hand. Several of the men were under arms, the small cutter was hoisted out, and the large one being got ready. I asked the boatswain how I should proceed, but he was as much at a loss as I, and in a confused manner told me to lend a hand in clearing the boat and getting her out, which I did. When she was out the smaller one was got in again, and Mr. Christian ordered Churchill to see the master and clerk into the boat. Mr. Bligh then tried to reason with Mr. Christian, but the latter replied, 'Silence! not a word or death's your portion.' When Mr. Bligh found that he must go, he begged of Mr. Christian to desist, saying, 'I'll pawn my honour, I'll give my bond, Mr. Christian, never to think of this if you'll desist,' and urged the consideration of his wife and family. To this Mr. Christian replied, 'No, Captain Bligh, if you possessed any honour things had not come to this; and if you had any regard for your wife and family you should have thought of it before, and not behaved so much like a villain.' Mr. Bligh attempted to speak again, but was ordered to be silent; the boatswain also tried to pacify Mr. Christain, but he replied, 'It's too late; I have been in hell this fortnight past, and am determined to bear it no longer; and you know, Mr. Cole, that I have been used like a dog all the voyage.' In getting the things into the boat a dispute happened between Churchill and the carpenter about the tool chest, which Churchill wanted to keep in the ship, but by Mr. Christian's orders it was allowed to go in the boat. The masts and sails were also got in, and all the new canvas, with nails and saws, and Mr. Bligh's and the master's clothes, two casks of water, three bags of bread, Mr. Bligh's spirit case, some bottles of wine, and several other things. Mr. Bligh was then brought to the gang-way, and his hands cast loose,

and he went into the boat. After he was in he begged for his commission and his sextant. The commission, and also his pocket book and private journal, were instantly given him by Mr. Christain's orders; and Mr. Christian took up his own sextant and handed it into the boat with a 'Daily Assistant,' saying, 'There, Captain Bligh, these are sufficient for every purpose, and you know the sextant to be a good one.' Mr. Bligh begged for a musket, which was refused, but Mr. Christian ordered four cutlasses to be handed in, and twenty-five or twenty-six four-pound pieces of pork and two gourds of water, as well as several other things: after which the boat, containing nineteen hands, was cast off—about eight o'clock in the morning. Mr. Christian then called together the hands left in the ship (twenty-five in number, including two of the midshipmen, Mr. Heywood and Mr. Stuart) and explained to them the cause of this sad affair, to the following effect:—Being much hurt by the treatment he had received from Mr. Bligh, he had determined to quit the ship the preceding evening, and had informed the boatswain and carpenter, and Mr. Stuart and Mr. Heywood of his resolution, who supplied him with some nails, beads, part of a roasted pig, and some other articles which he put into a bag and hid the bag in the clue of Robert Tinkler's hammock. Mr. Christian also made fast some staves to a stout plank, by which raft he intended to make his escape, but finding he could not do so in the first and middle watches, he went to sleep about half-past three. When Mr. Stuart called him to relieve the watch, he begged Mr. Christian not to make the attempt, and added that the crew were ripe for anything. This made a great impreson Mr. Christian, and he at once resolved to seize the ship." Peter Heywood subsequently related, from what he knew of the circumstances, that it was Christian's first intention to take Captain Bligh a prisoner to England in the "Bounty," and to demand a trial by court martial. It was probably the knowledge he possessed of the partiality of the tribunal towards those in authority which drove him to another course; and it must be borne in mind that the mutiny was conceived and executed upon the impulse of the moment, and gave no opportunity for reason to assert her sway over a mind goaded to desperation by the bitter sense of

wrong and outrage. Morrison, after concluding a detailed history of the mutiny, goes on to say: "Mr. Christian, now finding himself master of the ship, ordered the plants to be thrown overboard, and the cabins cleared, which was finished by the 1st of May," and after a council of war it was agreed to sail back to Otaheite. The remembrance of how the winter had been spent there caused this decision to be hailed by a general shout of "Hurrah for Otaheite!" But Lady Belcher states, on the authority, as she has informed me, of her step-father, Peter Heywood, that Christian was himself a changed man. "A reaction had taken place; passion and resentment had cooled. He stood with his arms folded in moody thought and with his eyes riveted in the direction of the boat. Nor was it a matter of surprise that such should have been the case. What would be the result of the mutiny to himself? Degradation; and should he ever fall into the hands of his countrymen, the death of a felon."

Before pursuing the "strange eventful history" of the mutineers, and of Captain Bligh and the other castaways, I will ask you to consider the verdict which impartial posterity should pronounce upon Fletcher Christian's part in the mutiny. I suppose nearly everyone now-a-days will admit that individuals as well as nations have an ultimate right to rebel against injustice and tyranny. In this case, therefore, the great question to direct our judgment is, whether or not the treatment of Christian by Captain Bligh was such as to give a moral warrant to the act of mutiny; and if this can be settled in the affirmative, there remains the lesser question, whether or not the mutiny of the "Bounty" was undertaken in as humane a manner as could reasonably be expected under the circumstances. I do not hesitate to say that a careful investigation of all the data which exist relative to Christian's character, and to the incidents connected with the mutiny, has led me to a conclusion in his favour upon both of these questions. I believe it can be clearly established—first, that Captain Bligh's treatment of Christian was so offensive and brutal, that no man, and least of all one who had been born and bred a gentleman, and who probably inherited through his mother the independent spirit of the old race of Cumberland "statesmen,"

could have endured it any longer; secondly, that Christian's antecedents raise a fair presumption that he was naturally incapable of breaking the most time-honoured traditions of the service, and the most inflexible laws of his country, except as a last resort against misused authority; and thirdly, that the mutiny was enacted not only with humanity, but, comparatively speaking, with moderation and indulgence towards the victims.

As to the amount of provocation received by Christian, the narrative of Morrison is pretty conclusive of itself; and the opinion of Peter Heywood (who was Christian's fellow-officer and a man of strict truthfulness), on the subject is, I know from his step-daughter, Lady Belcher, fairly represented in her reflections upon the scene of the mutiny. She says: "What a contrast was there between the stillness of nature and the terrible conflict raging in the breast of Fletcher Christian, as he paced the deck, brooding over his wrongs, and goaded as it were to madness by the coarse unfounded accusations of the preceding morning. For months these indignities had been borne with patience and forbearance; but now it seemed as if endurance had passed its utmost limits." That Christian's previous character was such as to indicate that he would not have resorted to mutiny without a reason sufficient to his own conscience, there is abundant evidence to prove. You have heard already Isaac Wilkinson's tribute to his youthful virtues; and there is every reason to infer that in this respect the child was father to the man. Captain Bligh, in his account of the mutiny, has not a word to say unfavourable to Christian's antecedents; but he describes him and Heywood as young men of great abilities who promised to be a credit to their country, and who had been the objects of his particular regard and attention.

After the trial of some of the mutineers three years later, when all England rang with the misfortunes of Bligh, and Christian was generally looked upon as the villain of the drama, Peter Heywood, who had just been condemned to death for his share in the mutiny but had received the royal pardon, wrote thus to Edward Christian (November 5th, 1792) —"Your brother was not that vile wretch, void of all gratitude, which

the world has had the unkindness to think of him; but, on the contrary, a most worthy character, ruined only by having the misfortune, if it can be so called, of being a young man of strict honour adorned with every virtue, and beloved by all (except one whose ill report is his greatest praise) who had the pleasure of his acquaintance." In the "Cumberland Pacquet" for November 20th, 1792, I find this paragraph in reference to the court martial: "For the honour of this county, we are happy to assure our readers that one of its natives, Fletcher Christian, is not the monster of wickedness which, with extreme and unexampled injustice and barbarity to him and his relatives, he has long been represented; but a character for whom every feeling heart must now sincerely grieve and lament. This character every officer and seaman, except one (meaning, of course, Captain Bligh) on board the 'Bounty,' who have yet arrived in England unite in bestowing upon him." When Joseph Coleman, one of the mutineers who was tried by the court martial but acquitted, was asked what he knew of Fletcher Christain, he replied "I only know he was a very good man to me." Perhaps there could be no severer test of a man's quality than the impression he would make upon the kind-hearted and hospitable Otaheitan people of that day; and Morrison says in his diary "Mr. Christian was beloved by the whole of them; but on the contrary none liked Mr. Bligh, though they flattered him for his riches, which"—(Morrison dryly adds)—"is the case even among polished nations, those in power being always courted!" Thus you will see that Mr. Heywood and Morrison not only agree in praise of Fletcher Christain, but also in suggesting the inference that his character formed a favourable contrast to that of Captain Bligh. And in regard to Bligh's character, and as bearing upon the degree of provocation received by Christian, I may quote the testimony of two other excellent authorities. The editor of the "Universal Library" says of Bligh: "His temper was infirm, and when under its influence he suffered himself to use language to his officers and crew" which gave rise to "many irritating altercations." And Lady Belcher states: "Captain Bligh, besides being of an irritable and passionate disposition, was of a most suspicious turn of mind. The language he indulged in

was so harsh and offensive as to be exceptional, even at a period when it was deemed that discipline could not be enforced without the use of profane and opprobrious epithets." I may add that a gentleman who married one of the Heywood family writes to me as follows: "My wife's aunt, Mrs. Aislabie, was often heard to say that previous to the mutiny Fletcher Christian was considered a man of high character; and her uncle Captain Peter Heywood, has repeatedly declared that Christian was nearly driven mad by the unfeeling conduct of Captain Bligh." As to the question of the manner in which the mutiny was carried into effect, Morrison's account of it, which substantially agrees with that given by Captain Bligh himself, puts Christian in the light of performing a painful duty with gentleness and consideration, rather than of gratifying his revenge upon a man who had cruelly wronged him. Not a drop of blood was shed, no personal indignity was offered to Bligh or any of his companions, and in supplying the boat with a fair stock of provisions and handing to Captain Bligh his own sextant and chart, Christian plainly showed that he had no design upon the lives of the castaways. And it must be remembered also that the mutiny occured at no great distance from groups of islands, some of which were known to yield abundance of food, and to be inhabited by tribes not unfriendly to the countrymen of Captain Cook. That Christian rushed upon his fate blindly and rashly, and with a culpable disregard of the issues of the proceeding to everybody concerned, the best friends to his memory cannot deny; but notwithstanding all this I hope you will now agree with me that up to this period Fletcher Christian was more sinned against than sinning; and when we come to the few incidents which survive of the rest of his career, I think you will still find more traces of good than of evil.

Meanwhile I will for a few minutes follow the fortunes of Captain Bligh and his eighteen companions whom we have seen cast adrift in the mid-Pacific, crowded into the launch of the "Bounty," which was an open boat no more than twenty-three feet long, six feet nine inches broad, and two feet nine inches deep. If the mutiny was, as I have endeavoured to show, fairly chargeable upon Captain Bligh's own misconduct, one must acknowledge that adversity had upon him the effect

that it often has upon the mysteriously compounded elements of human nature: it drove into the background all those faults and failings which had marked the days of his prosperity, and had at last brought upon him this terrible penalty, and it developed heroic qualities of mind that had hitherto lain dormant. Captain Bligh's first act after leaving the "Bounty" was probably in accordance with Christian's expectations; he directed the boat to one of the neighbouring islands (called Tofoa), either to seek a refuge until a ship should pass that way, or at any rate to procure an additional supply of water and provisions. In the latter object Bligh was partially successful, but the boat was suddenly attacked by the natives (who were much more savage than the inhabitants of Otaheite), and after losing one of his men in the fray, he was glad to regain the open sea. Disheartened by this affair, the men now begged their commander to make for the nearest European settlement. Unhappily there was none nearer than Timor, a distance of 1,200 leagues; but the men having all agreed to be content with one ounce of bread and a quarter of a pint of water each per day, on the 2nd of May they bore away towards Timor. The very next day a terrible hurricane set in, which lasted for many days; and to prevent the boat being swamped, everything that could possibly be spared had to be cast overboard. On the 5th they passed some islands, but after their experience at Tofoa they did not venture to land. On the 7th they passed some of the now well-known Fegee Islands, and were pursued by natives in canoes. In the afternoon a heavy rain came on, and increased their discomfort, but enabled them to add thirty-six gallons to their stock of water. This was chiefly accomplished by means of stripping off and wringing out their clothes as fast as they became soaked with rain! From the 9th to the 19th the luckless voyagers encountered a succession of storms which made constant baling necessary, and almost prevented their getting any sleep. So much labour, anxiety, and exposure, with so little food and sleep, now began to tell seriously upon their health and spirits. "I could look no way," says Captain Bligh in his journal, "but I caught the eye of someone in distress. Extreme hunger was too evident; the little sleep we got was in the midst of water, and we often awoke with

severe cramps and pains in our bones. I began to fear that another night would put an end to the lives of several who seemed no longer able to support their sufferings." Fortunately just then the wind abated, and an occasional tea-spoonful of rum helped to keep body and soul together. On the 25th they caught a booby—a bird the size of a duck—which was divided and devoured raw—entrails, beak and claws and all. Next day another booby was captured and similarly disposed of. On the 29th of May they reached the desolate coast of New Holland, where they obtained some oysters and dog-fish; but in two days they were driven off by the savages. About this time a mutinous spirit broke out among some of the men, mainly brought about by fatigue and despair; but it was overcome by the firmness and tact of Captain Bligh. Soon afterwards several men were attacked by alarming symptoms of illness. "On the morning of the 10th of June," says Bligh, "there was a visible alteration for the worse in many of the people. An extreme weakness, swelled legs, hollow and ghastly countenances, a more than common inclination to sleep, with an apparent debility of understanding, seemed to me the melancholy presage of approaching dissolution." However, relief was now at hand, for on the 14th they reached the Dutch settlement of Timor, after having run a distance of 3,618 miles in forty-one days. The poor sufferers when landed were scarcely able to walk; their bodies were nothing but skin and bone, their limbs were covered with sores, and they were clad in rags. "In this condition," adds Bligh, "but with tears of joy and gratitude running down our cheeks, the people of Timor beheld us with a mixture of horror, surprise, and pity,"—

> "The ghastly spectres, which were doomed at last
> To tell as true a tale of dangers past
> As ever the dark annals of the deep
> Disclosed for man to dread or woman weep."

There is certainly no exaggeration in the concluding paragraph of Captain Bligh's journal:—"Thus happily ended, through the assistance of Divine Providence, without accident, a voyage of the most extraordinary nature that ever happened in the world, let it be taken either in its extent, duration, or the want of every necessary of life."

After staying at Timor for two months to recruit their strength, and receiving every attention and assistance from the settlers, Captain Bligh and sixteen of his companions left for England. Mr. Ledward, the surgeon, preferred to remain behind, and five of the others died on their homeward journey. Captain Bligh himself safely landed at the Isle of Wight on the 14th March, 1790; and it need hardly be said that the tale of his experience, under such extraordinary and romantic circumstances, aroused much interest throughout the country. The mutineers' version of the chief event being as yet untold, it is not to be wondered at either that Captain Bligh became the object of general sympathy, or that Fletcher Christian and his comrades were regarded as culprits of the blackest dye. The Government lost no time in fitting out the "Pandora" frigate, under the command of Captain Edwards, to go out in search of the mutineers. She sailed direct for Otaheite, and arrived there on the 23rd of March, 1791.

Meanwhile Captain Bligh had been promoted to the rank of a Commander, and sent out a second time to transplant bread-fruit plants to the West Indies; and on this occasion he successfully performed his mission. He was afterwards employed in active service, and in command of the "Glatton" took a conspicuous part in the famous battles of St. Vincent, Camperdown, and Copenhagen. In 1805 he was appointed Governor of New South Wales. It is worthy of particular remark that in that capacity his judgment was again overturned by his bad temper, and that his offensive and arbitrary conduct was actually the cause of another mutiny. The New South Wales Military Corps, commanded by Colonel Johnstone, revolted against the Governor, deposed him, and sent him back to England; and though Colonel Johnstone was tried by court-martial and cashiered, so little further notice was taken of the matter as to indicate that Captain Bligh could not have had a very strong case. Bligh then retired into private life, and after attaining the rank of Vice-Admiral of the Blue he died in London in 1818, at the age of sixty-five years. Taking a final leave of Captain Bligh, whose capacity inspires one with respect, and his misfortunes with pity, notwithstanding all his faults, and leaving the "Pandora" at anchor off Otaheite, I now

revert to the story of the "Bounty," which had also reached Otaheite with the mutineers one year and nine months before the "Pandora," viz., on the 6th of June, 1789.

Christian's first object was to revictual the ship, and being, as we have already seen, a great favourite with the natives, he had no difficulty in obtaining supplies, including a quantity of live stock descended from the cattle, goats, and hogs which had been presented to the Otaheitans by Captain Cook. With these supplies, and accompanied by nine native men, ten women, and several boys, the mutineers sailed in the "Bounty" for the island of Tonbouia, which seems to have been pitched upon by Christian because of its remoteness from the track of ships, and where, in Morrison's words, "he hoped to be permitted to end his days in peace, which was all he now desired, knowing that he had taken such steps as had for ever debarred him from returning to England, or any civilised place." On the 23rd of June, 1789, after a very rough passage, they reached the island, and proceeded to land the stock and provisions, whilst Christian arranged with the chief for the purchase of land on which to build a fort and make a settlement. But before their arrangements were completed, Christian's plans were frustrated by the disaffection of many of his followers. Some who thought their share in the mutiny had not been such as to preclude them from the hope of pardon, began to quail before the prospect of dragging out the rest of their existence on this desolate reef, and clamoured to return to Otaheite, where they would be sure before long to fall in with an English ship. Others, consisting of the most lawless and depraved members of the party, disgusted Christian with their cruelty and injustice towards the natives, and especially the women, who are described by Morrison as possessing great personal attractions. As long as the mutiny of the "Bounty" is told in our language, I hope it will also be recorded that Fletcher Christian preferred to brave the anger of these ruffians and risk his own life rather than permit such wrongs to be continued. It was at length agreed that the settlement should be abandoned, that all should return to Otaheite in the "Bounty," that those who declined to abide by Christian's regulations and follow his fortunes should be left there, and

that the rest might have the ship and find another hiding place for themselves. This resolution was acted upon, and taking with them the Otaheitan emigrants and a young chief of Tonbouia, who had become devotedly attached to Christian, on the 22nd of September, 1789, they once more touched Otaheite. There the separation of the party at once took place; sixteen out of the twenty-five mutineers (including Peter Heywood and Morrison) elected to abide their chance at Otaheite, and then (to quote from Heywood's account of the occurrence) "Mr. Christian and the eight other men went away in the ship, but God knows whither!" They were accompanied by nine Otaheitan men and twelve women. Before leaving, Christian spent some hours with the young midshipmen, Heywood and Stuart, when he earnestly advised them to give themselves up to the first ship of war that passed Otaheite. Then turning to Heywood, he recapitulated the events of the mutiny, and declared that on that fatal morning his brain seemed to be on fire; and with a magnanimity worthy of his recent conduct at Tonbouia, he went on to exonerate all his adherents from any blame for the mutiny—which he took wholly upon himself. Finally he charged Heywood to communicate to his (Christian's) family, certain circumstances which he hoped would extenuate in their eyes, the offence he had committed against the laws of his country. He then bade a last farewell to his old comrades, who evidently regarded him with great esteem and affection; nor have I been able to find any other feeling towards him, amongst either his English or his Polynesian associates, except in the solitary instance of Captain Bligh. Morrison notes in his diary that even during the troubles at Tonbouia the most turbulent of the gang never failed in their respectful attitude towards their leader, and never spoke of him but as Mr. Christian.

From the departure of the "Bounty" in September, 1789, until the arrival of the "Pandora" in 1791, Heywood, Stuart, Morrison, and their companions continued to reside at Otaheite, and to receive from the natives every mark of kindness and distinction which it was in their power to bestow upon the fugitives. The chiefs freely endowed them

with lands and houses, and they were permitted to take their choice of wives amongst the belles of the island.

"The white man landed! need the rest be told?
The new world stretched its dusk hand to the old;
Each was to each a marvel, and the tie
Of wonder warm'd to closer sympathy.
Kind was the welcome of the sun-born sires,
And kinder still their daughters' gentler fires.
Their union grew: the children of the storm
Found beauty link'd with many a dusky form;
While these in turn admired the paler glow,
Which seemed so white in climes that knew not snow.
The chase, the race, the liberty to roam,
The soil where every cottage show'd a home;
The sea-spread net, the lightly launched canoe,
Which stemmed the studded Archipelago
O'er whose blue bosom rose the starry isles;
The healthy slumber, earn'd by sportive toils;
The palm, the loftiest dryad of the woods
Within whose bosom infant Bacchus broods;
The cava feast, the yam, the cocoa's root,
Which bears at once the cup, the milk, the fruit;
The bread-tree, which, without the plough-share, yields
The un-reap'd harvest of unfurrowed fields,
And bakes its unadulterated loaves
Without a furnace in unpurchased groves—
These, with the luxuries of seas and woods,
The airy joys of social solitudes,
Tamed each rude wanderer to the sympathies
Of those who were more happy, if less wise:
Did more than Europe's discipline had done,
And civilised civilisation's son!"

This extract, the only one I can make room for, from Byron's poem of "The Island, or Christian and his Comrades," epitomises the attractions of Otaheite, which are set forth by Morrison at greater length, and if in less poetical, at least in picturesque language and in an equally appreciative spirit. I may just observe, in passing, of Byron's poem, that it is of no value to us historically, seeing that the scene of Christian's adventures and death is laid at Otaheite, whilst as you will find presently the real tragedy occurred under entirely different circumstances, 1,200

miles away; and that, judged by its poetical merits, the poem can hardly be said to be worthy of Byron's genius. Morrison closes a minute and most interesting description of the island, from every point of view, with the words, "Such is the best account I have been able to collect of Otaheite and its inhabitants, who are without any doubt the happiest on the face of the globe." But the Arcadian pleasures of Morrison and his companions were at length rudely interrupted by the appearance of the "Pandora" upon the scene, and all of them either surrendered themselves to Captain Edwards or were quickly captured. They were at once put in irons, and from that day till the arrival of the survivors in England, they were treated by Captain Edwards with a cruelty and malignity for which there was no excuse in the case of men who had at the worst been only guilty of a passive share in the mutiny. It is impossible to read of their sufferings without indignation, and without being forced to the conclusion that if Commanders like Bligh and Edwards were fair specimens of their profession, the wonder is, not that this mutiny should have happened, but that mutiny was not more frequent and more fatal in the British Navy. Morrison relates with much pathos the terrible grief of their native wives at the loss of their husbands. He says it would have melted a heart of stone. When these hapless women, with their infants, attempted to get on board to reach the prisoners, and were driven away by the captain's orders, they sailed round the ship in canoes for many days and nights, making heart-rending lamentations, and lacerating their heads and bodies, in accordance with the native rites of mourning, until the sea was reddened with their blood. They could not have shown more fidelity and devotion to their quasi-husbands if they had been married after the latest and most approved fashion in Westminster Abbey.

For the next few months the "Pandora" sailed about among the Pacific Islands, in a vain search for the "Bounty." All this time the mutineers were cooped up in a small wooden hut on deck, which Morrison with a touch of his dry humour christened "Pandora's box," and which had only a small hole or "scuttle" at the top for ingress and egress. The heat of the place was so intense, and it was so over-run

with maggots and every kind of vermin, that the poor wretches had to discard their clothing. Their hands and feet were all shackled with iron, and three armed sentries were placed outside with orders to prevent any communication with the crew and to shoot anyone who spoke to another in the Otaheitan language. One day, probably owing to the shrinking of the men's wrists, Captain Edwards ordered the handcuffs to be reduced in size. In carrying out this order the first lieutenant would not be at the trouble to unlock a handcuff to take it off, but seizing it with both hands, and putting his feet against the man's breast, he pulled it by main force over the hand, bringing all the skin with it. On the 29th of August, in approaching the coast of New Holland, the "Pandora" struck upon a reef, and soon became a total wreck.

The story of the shipwreck is so graphically told by Morrison that I need not be afraid of wearying you if I quote it almost in full. He says: "The current running fast, forced the ship further on to the reef with violent and repeated knockings, and we expected every surge that the masts would go. Seeing the ship in this situation, we judged she would not hold long together, and as we were in danger every lurch of killing each other with our irons, we broke them off, and informed the officers what we had done. In the meantime the ship lost her rudder and part of the sternpost, and having heeled over between eleven and twelve, she was brought up in fifteen fathoms, with both anchors, and the first cry was, 'Nine feet of water in the hold!' Coleman, Norman, and Mc.Intosh (three of the prisoners) were now ordered out to assist at the pumps and to get the boats out. When Captain Edwards found we had broken our irons, he ordered the rest of us to be handcuffed and leg-bound again, though we begged for mercy, and desired leave to help at the pumps. The master-at-arms and the corporal were then armed with pistols, and placed as additional sentinels over us, with orders to shoot the first man who stirred; and the master told us Captain Edwards would shoot or hang at the yard-arm any man who attempted to break the irons. There seemed, therefore, no remedy but prayer, as we never expected to see daylight again; and having recommended ourselves to the protection of the Almighty, we lay down, and tried for a while to

forget our miserable situation. We could hear the officers busy getting their things into the boats, which were hauled under the stern on purpose, and we heard some of the men on deck swearing that the officers should not go without them. This made some of us start, and so move the irons, upon which the master-at-arms called out, 'Fire upon the rascals!' As he was then just over the scuttle, I spoke to him and said, 'For God's sake don't fire!' In a few minutes one of the boats broke adrift, and having but two men aboard she could not reach the ship again till another boat was sent to bring her back. And now we began to dread they would set off and leave us behind, as it was but natural to expect they would think of themselves first; however, they did return. The booms were next cut loose for the purpose of making a raft, when one of the topmasts fell and killed a man who was helping to heave the guns overboard. At daybreak the following morning, most of the officers came aft on the top of our box, and we could perceive they were armed, and preparing to go into the boats by stern ladders. We begged that we might not be forgotten, when by Captain Edward's order the armourer's mate was sent down into 'Pandora's box' to take the irons off Muspratt, Skinner, and Byrne; but Skinner being too eager to escape, was hauled out with his handcuffs on, and the other two followed him. The scuttle (or door) was then shut close and barred. In the meantime Hodges knocked off my hand-irons and Stuart's, and I begged the master to leave the scuttle open, when he answered, 'Never fear, lads; we'll all go to hell together!" The words were hardly out of his mouth when the ship give a lurch, and a general cry of 'There she goes!' was heard. The master and corporal, with the other sentinels, rolled overboard, and at the same instant we saw Captain Edwards swimming towards the boats. The water was rising fast upon us, and we should soon have been lost if Divine Providence had not put it into the heart of William Moulter (the boatswain's mate) to heed our cries. He scrambled on to the box, and saying he would either set us free or go to the bottom with us, he undid the bolts and opened the scuttle. On this we all got out except one, but it was as much as I could do to clear the ship before she sunk. The boats were now so far off that we could not

distinguish them; however, observing one of the gangways in the water, I swam towards it, and got upon it. I then saw that our prison (Pandora's box) had floated, and that some of the men were upon it. Presently Mr. Heywood passed me swimming towards the boats (he had his mother's prayer-book between his teeth), so I resolved to follow his example, and after being an hour and a half in the water, we reached the blue yawl, and were taken on board. After several others had been taken up, we were landed on a small sandy reef about three miles from the ship. Here we found that four of our fellow-prisoners had been drowned, two with their handcuffs on, but Birkett had actually swam to the land with his handcuffs on! Thirty-one of the 'Pandora's' crew were lost, including the master-at-arms and the corporal, but all the officers had saved themselves. A tent was pitched for the officers, and another for the crew, but Captain Edwards would not allow us a sail to shelter us from the sun, and we were ordered to keep apart by ourselves and not to speak to anyone. The sun took such an effect upon us, after we had been shut up for five months, that all our skin peeled off from head to foot, although, during the heat of the day, we buried our bodies in the sand, which was all the shelter we could get."

I must now quit Morrison's diary, which goes on to narrate their subsequent experience with a vividness and realistic force worthy of Defoe, and give you the sequel in a few words. After many weeks of privation and suffering in the "Pandora's" boats, the whole party at last managed to reach Timor, the same Dutch settlement where you will remember Captain Bligh and the other forlorn castaways of the "Bounty" had landed the year before. Captain Edwards, whose treatment of the prisoners in the boats had been as bad as in the "Pandora," no sooner landed here than he ordered all the poor wretches, half dead with hunger and exposure, and far more than half naked, to be put in the public stocks. After many further vicissitudes, Captain Edwards and his prisoners at last found their way to England, where they landed on the 19th June, 1792, four years and five months after the sailing of the now missing "Bounty" for Otaheite.

The same autumn the prisoners underwent trial by court-martial.

Three were acquitted; the rest were found guilty and condemned to death. Two of the latter, however, our old friends Heywood and Morrison, received the Royal pardon; the others were executed. The pardon of Heywood was mainly due to the unceasing exertions of his sister, Nessy Heywood, a lovely and accomplished girl; but unhappily the strain had been too much for her strength, and she died within a year of his liberation. The correspondence of the brother and sister, embracing some poetical effusions not devoid of merit, has been published, and forms an interesting part of the "Bounty" literature. After the pardon, Heywood was at once reinstated in the navy, and soon attained the rank of captain, and did good service in the naval wars of that period. He died in 1831. James Morrison, the author of the diary, also joined the service again, and was chief gunner on board the "Blenheim" when she was lost, with all on board, in 1807. One may imagine with what "yarns" the brave old gunner would entertain the fo'castle, when one thinks of his powers of description, and that his memory was a store-house of facts more strange and stirring than almost any creations of fiction.

In September, 1789, we left Fletcher Christian, with eight other mutineers, and a number of natives, on board the "Bounty," and sailing from Otaheite—as Heywood expressed it—"God knows whither." Twenty years passed away without any tidings of the voyagers, and public attention, absorbed in the more terrible drama which was then being enacted across the channel, had long ceased to concern itself with their fate. But suddenly the country was startled by news so passing strange, that at first it was hardly believed; but it turned out to be as true as strange. The news was that an American vessel which happened by mere chance to touch at Pitcairn's Island, there found an Englishman, called Alexander Smith (he afterwards changed his name to John Adams), who informed the captain he was the sole survivor of Christian's party of the mutineers, who had sailed from Otaheite twenty years before. There were also on the island thirty-four youths and women and children, who were the wives or offspring of Adams and his late companions. Five or six years later, two English ships of war, cruising in the Pacific, came

upon an island not marked upon their charts, and never suspecting it to be Pitcairn, great was the astonishment occasioned when a canoe came alongside one of the ships, and a youth in the canoe called out, in good English, "Won't you heave us a rope now?" This youth, when he got on board, announced himself as Thursday October Christian, eldest son of Fletcher Christian, and the first child born upon Pitcairn's Island. He was then twenty-four years old, six feet high, with dark hair and eyes and an open interesting countenance. "Added to a great share of good humour, we were glad to trace," says Captain Pipon, "all the features of an honest English face." He told them he was married to a woman much older than himself, one of those who accompanied his father from Otaheite. His companion was a fine handsome youth of eighteen, son of George Young, the midshipman. The young men informed the two captains of the principal events since the settlement of the island, but for further particulars referred them to an old man on shore, who turned out to be Smith, or Adams. The captain then landed, and received from Adams a narrative of his experience since the time of the mutiny. When they prepared to sail, Adams expressed a wish to accompany them to England; but Captain Pipon states that on this being made known to the little society, an indescribable scene of distress ensued. All the women burst into tears, and the young men stood motionless with grief, whilst Adams' daughter, a fine young woman, threw her arms round his neck, and entreated him not to leave all his children to perish. After this demonstration he was easily persuaded to abandon his project.

Nothing more was heard of the colony until 1825, when it was visited by Captain Beechey, of the "Blossom." The patriarch Adams was still alive, and the number of the inhabitants had increased to forty-six. From the statements made to him and to the two captains before mentioned, I will give such a brief outline as time permits of the events which connect the state of Pitcairn's Island in 1825 with the final departure of the "Bounty" from Otaheite thirty-six years before. It seems that on board the "Bounty" was a copy of Captain Carteret's "Voyage to the South Seas," which contains a description of Pitcairn's Island (discovered by him), and remarks upon the extreme isolation of

its situation. It was no doubt from reading this description that Christian came to fix upon the island as a last retreat for himself and his followers. It is only five or six miles in diameter; the shores are bastioned by huge rocks, one of which towers to the height of a thousand feet; but they enclose rich and beautiful valleys clothed in forests of palms. Here the "Bounty" discharged her freight on the 23rd of January, 1790, after which she was burned, so as to leave no traces that might lead to discovery. Christian then divided the island into nine equal portions between himself and the other mutineers, each of whom took a wife from the Otaheitan women, whilst the rest of the Otaheitans they had brought with them acted as servants, or slaves. Adams informed Captain Beechey that Christian's cheerful example was of the greatest service in reconciling his companions to their lot, and that his happy and ingenious disposition always secured him their respect and good-will. But the opportunity now given him for quiet reflection, after the turmoil and excitement of his life at sea, gradually led him into a mood of serious meditation, which lessened the sympathy between himself and the coarser, or lighter, natures around him. He sought out a cave on an almost inaccessible part of the coast, where he often spent whole days in solitude, except for the chosen companionship of his Bible and Prayer-book. Let us hope that he found more comfort in their contents than he was likely to derive from his own thoughts. As he gazed upon the waste of waters which probably for ever separated him from his native land, one may conceive, as has been said, that he felt like Cain, both as to the mode and the measure of his punishment. But however much Christian abstracted himself from the uncongenial society of the island, and abandoned himself to moods of lonely contemplation and contrition, he was never unmindful of the duties he owed to his neighbours and to his own household. Adams always assured his visitors that Christian preserved a good influence upon all his companions, and that amongst other things he induced them to join him in public worship.

One anecdote related by Captain Beechey affords a touching proof of Christian's care for his family. When Thursday October Christian was invited to join the Captain at luncheon he would not begin the meal

until he had stood up and said grace; and it was then elicited from him that Fletcher Christian had enjoined the practice upon his household, and had also taught its members to repeat this confession every day at noon: "Father, I have sinned against Heaven and before Thee, and am no more worthy to be called thy son!" For three or four years at first all went pretty smoothly upon the island, after which it became for a ime the scene of some terrible and bloody tragedies. One of the mutineers, Williams, whose wife had been killed by a fall from a cliff, insisted that the wife of one of the Otaheitan men should be given up to him. This act naturally excited the indignation of the Otaheitans, and led to a conspiracy amongst them to murder all the Englishmen; but the scheme was frustrated by the women, who had been let into the secret, and gave warning to the intended victims by singing them a song, of which the refrain ran: "Why does black man sharpen axe?—to kill white man." The result was a disturbance which ended in the death of two of the Otaheitan men. Two or three years afterwards the peace of the colony was again interrupted by a conspiracy of the Otaheitans, by whom five of the Englishmen were treacherously butchered. One of the five was Fletcher Christian himself, the hero of my story, who was shot down whilst quietly working in his garden. I have already put before you my interpretation of his motives and character, and I will not pause now to moralize upon his untimely fate. The account I have given of Fletcher Christian's end is the one which passed current among the Pitcairn Islanders in after times: but I should omit the strangest of all the strange stories about him if I did not tell you there is some reason to doubt this explanation, and to suppose that in reality Christian escaped from the island, and found his way back to England, to survive there for several years in seclusion and disguise. Many tales were rife, from sixty to seventy years ago, of his having been met and recognised in the woods and bye-paths in this neighbourhood, but by those who had too much sympathy for him and his family to betray the secret. It was also said that his first cousin, John Christian Curwen, M.P., used his great influence to prevent any official search being made for the fugitive. But the theory of Christian's return is supported by something

stronger than these rumours. One day at Plymouth Peter Heywood, now become Captain Heywood, was walking along the street, when a man, closely muffled, and with his hat slouched over his eyes, walked quickly past him. The figure and gait of the man so startled Heywood by their resemblance to Christian's that he followed him, and exclaimed, in a low voice, "Fletcher Christian!" The man stopped as if shot, and after turning half round he darted at full speed down a side lane. Heywood, greatly excited, followed as fast as he could, but the mysterious stranger was the better runner, and eluded his pursuer. Out of regard to the Christian family, Heywood said nothing at the time of his adventure, and it was possibly for the same reason that he used afterwards to speak of the man's likeness to his missing friend as only a "singular coincidence." A circumstance incidentally mentioned by Captain Beechey certainly lends countenance to the supposition of Christian's escape. He states that although Adams was frank and explicit on all other topics, he always tried to evade the subject of Christian's death, and professed entire ignorance of his burial-place. The statement seems of some significance, as it is a fair inference that if Christian had resolved to take advantage of an opportunity to escape, such as by reaching a passing ship in one of the boats of the "Bounty," he would be likely to employ Adams, the most trustworthy man left of his companions, both to assist in his escape and to help to draw a veil over his future by reporting his death to any English ships that might turn up. After Christian's escape, or death—whichever it was—the four remaining Englishmen at Pitcairn's Island lived in constant dread of being treated like the others, and having no longer Christian's humane authority to keep them in check, they resolved to destroy all the Otaheitan men, which they did, having actually persuaded the unfortunate women to aid them in doing so. Another interval of peace followed, to be disturbed at last by an element of mischief which has been the curse of all modern countries, large or small, namely, intoxicating drink. One of the men, M'Coy, had formerly been a distiller, and in an evil hour he discovered the art of extracting spirit from the root of a tree. M'Coy and another man (Quintal) thereupon abandoned

themselves to constant drinking. M'Coy died in delirium tremens, and Quintal's conduct became so dangerous to the others that in self-defence they took his life.

John Adams and Young the midshipman were now the only survivors of the nine mutineers who had found a refuge at Pitcairn's Island nine years before. They became seriously impressed by their forlorn state, and by the responsibility which devolved upon them as the sole protectors of so many helpless women and young children. The Bible and Prayer-book which Christian had diligently studied were sought out, and regular morning and evening prayer was established, as well as daily instruction for the children. Young being a man of good education, took the lead in this duty, but was zealously assisted by Adams, who also was at great pains to increase his own slender acquirements. Young, who had long been a delicate man, sank into the grave at the early age of thirty-six.* This happened in the year 1800, and from that time until his death in 1829, John Adams devoted all his energies to promoting both the outward and spiritual good of the population, which by and bye increased in number from the intermarriage of the children of the original settlers. Such was the success that attended his teaching and example that crime and vice were completely banished and forgotten, and for the first time perhaps in history there was to be seen the picture of an entire society of men, women, and children living in harmony and primitive innocence, and seeking for no greater pleasure than the happiness which waits upon virtue. Two years after the death of Adams a long season of drought caused so great a scarcity of fresh water in the island that the British Government induced the whole colony, now increased to eighty-seven souls, to migrate to Otaheite, where a sufficient tract of land was allotted to them by Queen Pomare. But the climate did not agree with the immigrants, many of whom were cut off by fever; and the loose habits of the natives were so distasteful to them that the survivors took the earliest opportunity of returning to Pitcairn's Island.

*It has been stated that the celebrated Mormon chief, Brigham Young, is a lineal descendant of this mutineer.

In 1832 an impudent impostor of the name of Joshua Hill found his way to the island, and pretending that he had been sent out as a governor by the Crown, he managed for six or seven years to usurp the supreme authority, which he exercised in a way to cause general discontent and unhappiness. In the end he was found out and taken away by a British ship, and peace and prosperity were restored. On the 23rd of January, 1850, the islanders held a great jubilee, to celebrate the settlement of the colony by the mutineers sixty years before. Lady Belcher says of this occasion:—"Well might the existing generation be proud of the happy state of the community, descendants of the men whose illegal acts had compelled them to seek concealment from the outer world. Of that generation all had passed away, oppressors and oppressed, the white men and their coloured associates. Violence had ceased, and this anniversary was celebrated in as fair a land and by a people as free from guile as any on the face of the earth." In 1854 Admiral Moresby stayed some time at the island with his ship, and his son, Mr. Fortescue Moresby, wrote an account of the visit, in which he pays an enthusiastic tribute to the industry, sobriety, hospitality, intelligence, and virtue of the inhabitants. He winds up by saying, "Truly, a more innocent or delightful race does not exist." In 1855 Captain Freemantle was sent by Sir William Denison, Governor General of New South Wales, to report upon the condition of Pitcairn's Island. Of the people he said, "I will only add my corroboration to their still remaining the same cheerful, docile, and unsophisticated community they have so often been represented to be;" but owing to the want of water and for some other reasons Captain Freemantle recommended their being again removed to some place more capable of sustaining their continual growth. Acting upon this advice, the Government set aside Norfolk Islands—no longer used as a penal settlement—for the exclusive occupation of the Pitcairn Islanders, and the following year they were removed thither to the number of one hundred and ninety-three persons, composed of forty men, forty-seven women, fifty-four boys, and fifty two girls, with all their worldly possessions. In 1857, Sir William Denison, accompanied by Mr. Fortescue

Moresby, visited Norfolk Island to investigate the condition of the settlers, which he pronounced to be perfectly satisfactory. During his visit he divided all the land amongst the heads of families, and established laws for the regulation of the island. In 1858 or 9, the "home-longings" of a few of the settlers induced them to return to Pitcairn's Island with their families. There they were found prospering and following the good example of their fathers, by Sir Wentworth Dilke, who visited the island eight years afterwards. Sir Wentworth relates that the first islander who came on board rushed up to the Captain, and shaking him violently by the hand, enquired with an earnest expression of simple loyalty, "How's Victoria?"

No later intelligence of Pitcairn's Island has come across my notice. Meanwhile the settlers at Norfolk Island continued to increase and multiply, and in ten years they numbered three-hundred, the two sexes being exactly equal. Most of the men had taken up with whale-fishing during a part of the year. The Bishop of New Zealand visited the island several times, and in 1869 he wrote, "They are really a friendly, kindly, amiable people." How they have fared since that date I am not able to tell you, but two years since I saw a letter in the "Times" which insinuated (I trust without foundation) that some of the vices of civilisation had begun to undermine the simplicity and rectitude which distinguished the descendants of the mutineers for more than seventy years. Thus ends a story as full of lessons for the preacher as it is of material for the poet and the painter; and if I have failed to tell it in a way to awaken your interest and sympathy, the fault has been with myself, and not with my subject.

OLD CUSTOMS AND USAGES OF THE LAKE DISTRICT.

By John Richardson (Keswick).

(Read at Cockermouth and Keswick.)

In this age of cheap newspapers, when every occurrence of the least consequence is chronicled, and almost every one reads the newspapers, it is to be presumed that most persons are perfectly well acquainted with the customs and usages of the present time, and therefore, the purpose of this essay is more particularly to notice some of the old customs of the district, which have either altogether passed, or are fast passing away.

In a progressive country like our own, manners and customs are constantly changing. Old things are passing away, and new ones taking their places; these, in a generation or two, to be again superseded by others, more in harmony with the ever improving and advancing state of society.

The customs and usages of a country, or district, therefore, are always a true indication of the degree of civilization, or culture, to which the people of such country or district, have attained; and are usually those best suited to the condition, or circumstances, under which they exist. To this it may perhaps be objected, that customs when once firmly rooted among a people, continue to be observed long after the state of things under which they were established has passed away, and when they have become altogether unsuited to the altered state of society. But, if we look more closely into the matter, we will invariably find that in those remote districts, where old customs and superstitions linger longest, there also civilization and improvement are lagging behind, that

there the majority of the people spend their leisure hours in talking a great deal about nothing, and that habits of reading and self-culture are the exception rather than the rule. In all cases, as soon as the mass of the people become sufficiently enlightened to see the absurdity and unsuitableness of an old custom, they let it drop quietly out of sight; and until that time arrives, no amount of persuasion, or even ridicule, will make them give it up. With respect to some of the old world usages which in a somewhat modified form are still observed in rural districts, such for instance as eating, drinking, and smoking at funerals, there is very little doubt, but that many of the more intelligent members of the community would be glad to give them up, but for a dislike of being thought singular, or stingy; and as soon as the majority has become enlightened enough to see them in the same light, they will be discontinued.

We will now proceed to notice a few of the customs formerly prevalent in the Lake country; and as many of them may no doubt appear incongruous, and ridiculous enough to us at the present time, the few foregoing observations may serve to remind us that, whatever we may think of them now, there was a time when they were in perfect keeping with the old-fashioned, uncultivated ways of the dwellers among the Cumbrian hills.

The three great epochs of life—Birth, Marriage, and Death—have in all ages been marked by particular customs and observances, varying according to the different ideas and beliefs of the people among whom they prevailed.

Beginning with the Birth customs of the district, there was one in particular which belonged exclusively to the dales of Cumberland and Westmorland, viz.—the custom of making sweet-butter. As it is still occasionally made, there are probably few persons who live in the district who have not seen and tasted it; but if there should be any such here, it may be as well to explain, that it simply consists of soft sugar moistened with rum, and then mixed with an equal weight of melted butter. This mixture being well stirred together, is poured into a basin, and when cooled, is fit for use. It is eaten with bread, the thin oat-meal cake once so common in the district being accounted best for the purpose.

Down to a very recent date, it was an invariable custom, some weeks before a child was expected to be born, that a large china basin which was called the sweet-butter basin, (which was generally an heirloom in every family) was filled, to be in readiness; and as soon as the important event was safely over, this basin was brought out, and all in attendance invited to partake of its contents, the doctor being usually honoured with the first cut. It was afterwards offered, with oat-bread and ale, to every one without exception who called during the ensuing month. At the end of the month there was what was called an "Old Wife do." All the married women within a certain radius, which was termed the "Laatin," were invited to go and drink tea, eat sweet-butter, and rejoice with the mother for her safe deliverance. It was the custom, too, on that occasion for each guest to bring a gift—a pound of butter, a pound of sugar, or a shilling, was the usual offering. There was also another curious custom connected with the old wife do's, which was termed "Stealing the Sweet-Butter." A number of young men of the neighbourhood, assembled in the evening, and waited outside the house, until the table was spread and the women all seated round it, when two or three of the boldest youths rushed in, and seized, or attempted to seize the basin and carry it off to his companions; but as many of the old wives were prepared to make a desperate fight for it, it was frequently no easy matter to secure the prize, and get out again; and it often happened that some silly pilgarlick was glad to escape minus his coat-tails, or perhaps some more important part of his habilaments. When they succeeded in getting the basin of sweet-butter, a basket of oat-bread was handed out to them, and they went to some neighbour's house to eat it, after which each put a few coppers into the empty basin and returned it to the owners. Another curious custom connected with the old wife do's remains to be described. This was, "Jumping the Can." A large milking pail was placed on the middle of the floor, and in it was stuck a birch broom without the handle. Over this each of the women was expected to jump. It was no great height, and those who were young and active went over easily enough, but there were others who did not succeed so well, and that constituted the fun of

the thing. Only imagine the ladies of the present day, with their long trailing skirts and their tight aprons, attempting to jump over the can with the beesom stuck in it!

Passing from Birth, to Marriage customs, we may remark, that the bidden weddings and bridewains, so graphically described by some of the old Cumbrian writers, were altogether exceptional affairs, only happening now and then, and by no means general or customary. They seem to have been got up occasionally by persons who had an eye to the main chance, purely as money speculations, and never to have become common enough to deserve the name of a custom, so that we need not further allude to them here.

The common weddings, however, were usually celebrated by a good deal of sociality. There were generally ten or a dozen couples of young people, who went to church; and as the distance was frequently several miles, they travelled on horseback, there being then neither wheeled carriages nor roads suitable for them. There was always a public house not far from the church, where they put up their horses during the ceremony, and to which they adjourned after it was over, to drink health and happiness to the newly married couple. This having been done to the satisfaction of all parties, the horses were brought out, and all being fairly mounted, the word was given, and a race home took place, the prize being a ribbon to be presented to the winner by the bride. Mounted on their rough and shaggy farm horses (many of which carried double), a neck-break race of six or eight miles over such roads as they then had, was no joke, and many were the disasters which resulted. After a great deal of feasting, drinking, singing, and dancing, the last act at an old-fashioned wedding was throwing the stocking. The bride having retired, all the young women entered the room, and stood at the foot of the bed, when she sat up with her back towards them, and threw her left leg stocking over her shoulder, and the girl who chanced to be hit by it was supposed to be the next to be married.

The Funeral customs of the district, although, perhaps, still capable of improvement, have been greatly modified since the beginning of the present century. It was formerly the custom when a person died, and

the body was laid out, to have watchers through the nights which intervened between the death and burial. These were always two of the nearest neighbours, who sat in an adjoining room, and went at stated intervals to snuff the candles, which were kept burning near the corpse, and to see that all was right.

The afternoon before the funeral, all the married women in the "Laatin" were invited to go to what was termed the winding, which meant the placing of the body in the coffin; but as this might be done in a few minutes, by two or three persons, the gathering was in reality a tea party, where, solemn though the occasion might be, a good deal of gossip was sure to be retailed. To the funeral itself, two were invited from every house in the "Laatin," which included a much larger circuit than the "Laatin" to the winding, and these, with the friends from a distance, usually made a pretty large gathering. A substantial dinner was provided for all comers, as well as a supply of ale and spirits, and tobacco for those who chose to smoke. At the time appointed for starting to church, which was often about three o'clock, the coffin being brought outside the door and placed upon the bier, the mourners standing near, four verses of the sixteenth Psalm were sung. The way in which this was done rendered it a somewhat slow and monotonous proceeding. A line at once was given out, in a peculiar sing-song tone, by the clerk, or sexton, and then sung by a few of those present, then another line, and so on through the four verses. The next step was termed lifting the corpse, when four men lifted the bier, shoulder height, and walked solemnly away towards the church, followed, first by the mourners, and then by other friends and neighbours. As the distance was often two or three miles, or even more, the bearers were relieved by fresh relays of men, at certain places on the route.

In the quaint old times of which we are speaking, they were very particular at funerals, about going the right way to church. From every hamlet or homestead, to the parish church, was a particular road, or path, called a corpse road, and so exact were they on these occasions, to keep upon that path, that in time of flood, a funeral party has been known to wade knee deep through the water, rather than deviate a few

yards to the right or left. There was a general belief, which has partly come down to our own times, which in some degree accounts for the scrupulous exactness with which they kept upon these old established paths. It is a vulgar error of course, but there are old people yet living who will tell you, that if a corpse on its way to church, is carried by a fresh way across the fields, that way becomes a public road for all time, not to be stopped by any thing short of an act of parliament, if by that. The ceremony over, and the body left in its last resting place, as many of the attendants as chose went back to the house, where each was presented with a small loaf of bread to take home. This was called arvel bread, and was originally given only to the poor, but afterwards came to be offered to all alike.

Turning to the periodical customs, or those observed at particular seasons of the year, we find, that many such have disappeared within the memory of persons now living, and still more, if we go back another generation or so. In treating of these, it must not be supposed that they all belong exclusively to the district. The purely local customs are very few, and in looking into the matter, we find, that many which have commonly been considered such, have had their counterparts in other places widely separated from each other. Most customs, however, have in each district, something quite local in the way of their being observed.

Very many of the old customs observed by our forefathers no doubt had their origin in some religious or superstitious belief. For instance, the customs once common in these counties of making bonfires at midsummer, and burning the Beltain, or Baalfires at Mayday, were no doubt relics of the fire worship, which was universally practised among the Celts. In like manner, the custom of visiting, what were called holy wells, upon particular days, and waking the well, once much observed in Cumberland, most probably came from a belief in water spirits, a superstition which was a part of the Scandinavian mythology. There were several holy wells in the Lake District, at which annual meetings were once held. Near Penrith were four such, which were visited in succession on the four Sundays of May, on which occasions drinking tents and confectionary stalls were erected, and various sports and diversions indulged in.

Whatever might have been the primary meaning, or origin of any particular custom, whether religious or otherwise, its annual observance always in time became supplemented by sports and rejoicings, frequently by athletic games, and in very many cases, these festivities were kept up and celebrated for hundreds of years after the first meaning and intention of the observance were altogether lost and forgotten. As a familiar example of this, we may take the Rushbearings, once so common in the north. Two or three hundred years ago, the country churches, and places of worship, in the Lake District, were many of them little better than barns. They were open to the roof, with benches of the rudest description for seats, the floors being neither flagged nor boarded, but simply the bare earth, covered thickly over with rushes. On a particular day in each year, usually in autumn, the parishioners assembled, to take the old rushes out and carry new ones in; and this being completed, a special service was held, the intention of which was, to bless, or consecrate the rushes, which had just been spread over the floor. In time, this became a festival, friends were invited from a distance, sports on the green were got up, and the day ended with drinking and dancing at the village inn. Now, it is probably more than a hundred and fifty years since any church floors have been strewed with rushes, and yet there are several places, such as Grasmere, Ambleside, Warcop, and others, where the festival has been observed annually, almost down to the present time. At some of them it is kept up still. The present practice at these gatherings is, for the children to walk in procession round the village, bearing garlands and other floral devices, which they afterwards deposit in the church, where a service is then held, and although it may seem a curious mixing up of things sacred and profane, the day ends as of old, with athletic sports and a dance at the public-house.

Of all the seasons of the year, which were marked by our ancestors with particular observances, Christmas was perhaps the most noted. Religious both in origin and name, as it was, and although, after the lapse of many centuries, it retains all its sacred character and associations, there is no season of the year around which so many purely secular customs and festivities have clustered, and in no part of the island were

Christmas customs formerly more observed than among the hills of Cumberland and Westmorland.

In order to understand the general hospitality which then prevailed, we must remember, that at the middle of the last century, society in the rural parts of Cumberland and Westmorland, was very differently constituted from what it is at present. Instead of there being Landlords, Farmers, and Labourers, which now form three distinct grades, the land was divided into a great number of small estates, each occupied by its owner, and cultivated by himself and his family; so that the head of every house was landlord, farmer, and labourer, at the same time. Most of these holdings were so small, that with the then imperfect modes of cultivation, their produce was quite insufficient to support the families of their owners, who consequently had to eke out a living by hand carding, spinning, and weaving the wool, shorn from their mountain flocks; an employment with which they occupied themselves during the long winter evenings; in wet weather, and at other vacant times. In a community so constituted, all were socially equal, and when there was any important event to be celebrated in a family, all the neighbours within a certain distance, were invited to go, and partake of the hospitalities and join in the rejoicings of the occasion. Even the clergy assisted in the fieldwork, at busy seasons, and mixed freely with the people, in their sports and revellings. We learn from old authors, as well as from tradition, that on Christmas eve, all work was suspended, and with the exception of attending to the cattle, was not resumed until after the twelfth day. During this fortnight the whirr of the spinning wheel was never heard, the looms were silent, and the flails hung idle in the barn, while the people went from house to house, feasting, singing, dancing, and card playing. Every dwelling was visited in turn, the Christmas pie, home-brewed ale, and ale possets without stint, were provided by every housewife. Soon after the commencement of the present century, a great change took place in the district. When machinery came to be applied to manufactures, the trade all went into the towns, hand-carding, hand-spinning, and country weaving were thrown out of use, and the dalesmen found that the better half of their occupation was gone. In a

few years many of the small holdings passed into other hands, and eventually, two or three, or even more of them were thrown together, and let as one farm. This change reduced two-thirds of the population to the condition of labourers, or farm servants, and the farmers and their families reckoning themselves a degree above these, left them out of their Christmas parties, and then it was that the Christmas merry-nights sprung up. These were held at the public-houses and served two purposes. They were places of amusement for all who chose to go, and also annual benefits to the inn-keepers who made them. Some of them were simply gatherings at public-houses, where no stated charge was made, but every one was at liberty to spend and drink what he chose. At others, each guest paid a shilling, or eighteenpence, for which they were supplied, in some cases with supper, and in others with a basin of "Powsowdy," which was simply the old ale posset mixed with rum. As might be expected from the rough uncultivated manners of the people, the proceedings at these assemblies were often of the wildest description. There were dancing and singing, card playing, drinking and fighting. There was no etiquette, or ceremony there; every one made merry in the way he liked best, and did it in the most energetic manner. Anderson in describing the Bleckell merry night, tells us, that, "The clogger o' Dalston" danced "Till the sweat it ran off at his varra chin end."

The mummers of Yorkshire, and the Christmas carol singers of other parts of England, had their counterpart in this district in the country fiddlers who on Christmas and New Year's eves, went about to every house, and after playing the "Hunt's up," wished the inmates a merry Christmas and a happy New year. In ancient times, it was the custom to herald in the New year with much pomp and ceremony, but in these northern counties the Christmas festivities extending a week into the new year, there was no room for any special New year rejoicings. It was, however, the custom at some churches, for the bell-ringers to ring the old year out and the new one in; and it was also very common for young people to sit up on that night until the clock struck twelve, and then open the door to let the New year in. There was also a custom, very common on New year's day, in many villages of Cumber-

land, called Stanging, which was highly characteristic of the days when the old parish constable was the sole guardian of the peace. A party of roughs assembled in the morning of the first of January, and continued throughout the day, to intercept all passengers, and extort from them a sort of black mail. If the person stopped was willing to pay sixpence or a shilling, he was suffered to go on his way without further molestation; but if not, he was hoisted by main force shoulder height, upon a pole, and carried to the public-house, by which time he was generally ready enough to pay his ransom, when he was set at liberty. The money thus obtained was all spent at the village inn, during the same day and night.

Passing to Candlemas, the observances among our forefathers at that season, were more of a business than a festive character. It was the end of their financial year, when all accounts were settled. All interest on borrowed money then became due, and most of the farms and tenements were let to be entered upon at that time. In Westmorland and the north of Lancashire, it was the custom until lately for all tradesmen to give twelve months credit, and no accounts were settled at any other time than Candlemas.

Coming next to Shrovetide, or the beginning of Lent, we find that most of the names and customs connected therewith have come down to us from Roman Catholic times. The name Lent is said to be derived from a term used by the Saxons. They called the spring—Lengthentide, because then the days were lengthening. Shrovetide originally signified the time of confessing sins to a priest. The term was derived from the Saxon word shrive, to confess, and was applied to the first day of Lent, because on that day the people in every parish throughout England, were obliged to confess their sins to the parish priest, each in his own parish church. In our own county, and perhaps some other parts of the north, the beginning of Lent was formerly called Fasten's even, because of its being the eve of the long Lenten fast. In the north of England, and especially in this county, the three days at the beginning of Lent have, time out of mind, been known as Collop Monday, Pancake Tuesday, and Ash Wednesday; and till lately, each was commemorated

by a meal corresponding to the name. The two former evidently date from before the reformation. Under the Roman Catholic rule Monday in Shrove week was the last day on which people were permitted to eat meat, until the end of Lent; and in consequence every one contrived to have it on that day, and hence it came to be called Collop Monday. Of the origin of making Pancakes on Shrove Tuesday, many widely different accounts have been given. The most obvious explanation seems to be, that the people being debarred the use of meat during the whole of Lent, eggs would be much used as a substitute, and the housewives of the time would, no doubt, for the sake of variety, contrive various ways of cooking them. They made them into pancakes and puddings, they mulled ale with them, and they dyed them into pace eggs for the children. Ash Wednesday is a remarkable example of the curious way in which, among dialect speaking people, words sometimes become corrupted both in pronunciation and meaning. It was called Ash Wednesday because, in early times, on that the second day of Lent, it was the custom for devout christians to sprinkle themselves with ashes, in token of sorrow and humiliation. In later times, however, after the old religious observances were discontinued and forgotten, the day came to be called not Ash, but *Hash* Wednesday, and the country people commemorated it by having a hash to dinner on that day.

The second Sunday before Easter was formerly called Carling Sunday, and it was a very general custom, in the northern counties, on that day, to offer visitors peas, which had first been boiled, and afterwards fried in butter, and were called carlings. It was also common for people, on that day, to carry raw peas in their pockets, and to throw them at each other. The origin of this curious custom is very remote. For centuries before the introduction of the potatoe into England, and when grain was imported in very small quantities, if at all, pulse was one of the chief staples of food, and at that particular time in the spring, when the winter stores of the poor were all exhausted, it became a custom for charitable people to make a distribution, or dole, of peas, to the serfs, or carles, and hence it came to be called Carling Sunday. In some of the midland counties, doles of wheat are given out in the same manner.

The custom of Pace Egging, at Easter, common among children all over England and some parts of the continent, is still pretty generally observed in this district; while the more local ones of drinking mulled ale, on Easter Sunday, and providing the children with new clothes for that day, are well nigh obsolete. The latter custom was once so general, that if any poor child was compelled to go out on that day, without wearing anything new, the other children thought that something terrible would happen to it. The practice of sending persons on foolish errands on the first of April, is so ancient, that its origin seems to be lost in obscurity. A great deal has been written by way of attempting to explain the meaning of this singular custom, but the accounts are so various, and all seem so purely conjectural, that no reliance can be placed upon them. In Cumberland, the same thing was practised on both the first of April and the first of May, the only difference being, that the dupes at the one time were called "April Noddies," and at the other "May Geslins." Noddy, in the dialect, means one easily imposed on, and geslins are young geese, which are often hatched about the first of May. There is strong evidence, both in some place names in the district, and particular phrases still used in the dialect, that the Mayday rejoicings once so popular in other parts of England, were common in the north. This very ancient festival was pagan in origin. It was a custom among the Britons, before they were converted to Christianity, to erect Maypoles adorned with flowers, and dance around them, in honour of their heathen deities. In the time of our Saxon ancestors, the festival was somewhat modified, but still retained its chief characteristics. The beginning of May was the time which the Saxons had chosen for the assembling of their "Folkmotes," or conventions of the people; and when the barons were absent at these ancient Parliaments, the inhabitants of each village gave themselves up to mirth and rejoicings. The feast was dedicated to Hertha, the goddess of peace and fertility, and all quarrels were to be laid aside during its continuance. On Mayday, the young people met upon the green around the richly decorated May poles, where they chose a village king, as he was called, who afterwards selected his queen. He wore an oaken, and she a hawthorn wreath, and together they gave

laws for the rustic sports, and bestowed the prizes upon the victors. After the Norman invasion, the May-day observances continued to be as popular as ever, and down to the time of the Commonwealth, every village had its May pole, where on the first of May in each year, the youths and maidens assembled, and having decorated the pole with garlands of flowers, they chose and crowned the May-queen, after which dancing on the green and various rural sports were kept up during the remainder of the day. In the time of Cromwell, the Puritans set themselves against these rustic rejoicings, and, in obedience to an ordinance of the long Parliament, dated April, 1644, all the May poles were taken down by the constables and churchwardens. After the Restoration, the festival was partially resumed, but never again became so popular or general as before. Bourne tells us that, in his time, in the villages in the north of England, the children of both sexes were wont to rise a little after midnight on the morning of the first of May, and, accompanied with music and the blowing of horns, to walk to some neighbouring wood, where they broke down branches from the trees and adorned them with nosegays and crowns of flowers. This done, they returned homewards with their booty, about the time of sunrise, and decorated their doors and windows with the same. Alluding to the Restoration, we may remark in passing, that on the twenty-ninth of May, called Royal Oak day, it was customary to carry about oak branches, in commemoration of Charles the Second's escape in the oak tree, after the battle of Worcester. In the old coaching and carrier cart days, the horses on that day used to be decorated with oaken twigs.

Coming next to Whitsuntide, if we endeavour to find out the meaning of the name, we become quite bewildered among the various explanations given by different authors. One writer tells us that it was "White Sunday," because in the early days of Christianity the converts who went to be baptised on the day of Pentecost, were all dressed in white. Another tells us that it took its name from a French word pronounced "Huiet," which meant eight, because beginning with Easter, Whit-Sunday was the eighth Sunday. Another quaint old writer on the subject says, that it was not *Whit*, but *Wyt*-Sunday, because at that time

the disciples were endued by the Holy Spirit with wit and wisdom to teach and instruct the people in the Christian religion. Still another writer informs us, that it was pagan in origin, and did not become identified with the Christian holiday of Pentecost till after the Norman conquest, and that its original name was Wittentide, because it was the time when the Wittenagemote, or Saxon Parliament, assembled. Whatever may have been its origin, or the derivation of its name, it is best known to Cumbrians as a hiring term for farm servants, and the time at which, in conjunction with Martinmas, the statute fairs are held. It is difficult to understand why Whitsuntide should have been chosen for such a purpose, as, being a moveable feast, whilst Martinmas is fixed, it very rarely happens that the two divisions of the year are of the same length, and not unfrequently the winter half-year, as it is called, is thirty weeks, leaving the summer division only twenty-two. It was formerly the custom for all masters requiring servants, to attend some or other of these fairs, and there to hire such as seemed most suitable to them. The servants, male and female, stood promiscuously in the market place, with pieces of straw in their mouths, as badges of servitude, or signs that they were open to engagements; and the masters went among them in much the same manner as they might have done among a herd of cattle, out of which they wished to purchase two or three heifers, and their mode of choice was exactly the same, the judgment in both cases being guided by the physical appearance of the animal to be bought or hired. Having made a selection, and a bargain as to the amount of wages to be paid at the end of the next half-year, the master gave the servant a shilling, which was understood to make the agreement binding. This money was called "Yearls," probably from a custom once common, of hiring servants by the year; thus when a master hired a servant for a year, and gave him the shilling, he was said to yearl him, or bind him for a year.

A great deal has from time to time been written and said in condemnation of the half-yearly hirings, and at one time they possibly deserved all the odium which has been attached to them. However, to judge of them impartially, it will be necessary to go back some forty or fifty years, to a time when country servants were in a very different

position from what they are at present. The wages they then got were less than a third of what they receive now; and when at the end of the half-year, they had paid their shoemaker's and tailor's bills, the few shillings which remained were too often squandered before the term was over. They then commenced another half-year of toil and drudgery, during which time they seldom left the farm, having neither the opportunity nor the means of going away in search of excitement or pleasure. It would be difficult to imagine a rougher set of people than most of the farm servants were fifty or sixty years since. Thoroughly uncultivated in appearance and in manners, while at the same time many of them were overflowing with animal spirits and rollicking fun, which seldom found a free outlet at any other time, it is scarcely to be wondered at, if when they got to the fair, they threw off all restraint and rushed into every kind of excess. While, however, we are looking at this dark view of the subject, and cannot help lamenting such excesses, and the immorality which they undoubtedly sometimes led to, we must not forget that the picture had a bright side too. Among the poorer families, many of the members of which were out at service in different parts of the country, and who seldom or never met at any other time, the hiring day being the only opportunity they had to form a reunion during the six months, on that account was always looked forward to with the brightest anticipation. It was a kind of oasis in the desert of labour and servitude, where father, mother, sisters and brothers all met together to shake hands and exchange affectionate greetings, after a half-year's separation. The mother went shopping with her grown-up children, advising them how to lay out their wages to the best advantage, and in return, having her basket filled with fairings for herself and the children at home. The hiring fairs are still kept up to some extent, but are altogether modernized in character. The march of improvement is nowhere more perceptible than among the agricultural servants of the northern counties. If in the manufacturing and mining districts high wages have led to reckless extravagance and intemperance, they have had the very opposite effect upon farm servants. When at the end of the half-year, they found that, after making their necessary purchases, they had a few pounds to spare,

it was worth while to put them in the savings bank; and the very fact of their having an account there, led them into habits of sobriety and economy, and gave them feelings of independence and self-respect, which they had not had before. With few exceptions, too, they are now able to read and write; and availing themselves of the increased facilities for travelling, they go more from home, and are consequently as a class much better informed, and more civilized in every way. There are still, of course, specimens of the old boorish type to be found here and there, but they are getting fewer year by year, and will no doubt in time disappear altogether.

The midsummer rejoicings, once general throughout England, were partly kept up in the north, till the beginning of the present century. In Hutchinson's history of Cumberland, 1794, we learn, that at Cumwhitten, the festival was then celebrated with bonfires and dancing; and Sullivan tells us, that the same custom was observed at Melmerby several years later still. At Michaelmas it was the custom among our forefathers to kill their cattle out of the pastures, for their winter provisions; and in October they brewed their ale for the ensuing year. There are other local customs, such as clippings, shepherd's feasts, and kurn suppers, which are still partly observed, and therefore do not require much explanation.

Forty or fifty years since, sheep shearing time, which extended over the second and third weeks of July, was quite a festive season among the vales. Every flock master made a clipping, to which he invited all his neighbours and friends; and every housewife made a brewing of extra strong ale, called clipping drink, for the occasion, and to it the dalesmen always did ample justice before they went home. The shepherd's feasts do not date very far back, being simply meetings of shepherds from the surrounding vales, which are held at some particular inns. To these meetings, all the stray sheep picked up on the mountains during the autumn are brought, and after being claimed by their respective owners, a supper is provided by the host, and the evening is spent in conviviality. The kurn suppers of the district correspond to the harvest homes of other parts of England, and the name is another example of the way in

which words sometimes become corrupted. It was originally called the "Corn winning," because it was a feast held by the country people when they had won, or secured their corn crops. It afterwards came to be called the "Kurn winning," and "Kurn" being the dialect word for churn, it became a custom for each of the family and work-people to be regaled with a basin of cream, as a part of the feast, and thus it became the kurn, or churn supper.

I will now conclude with a few brief remarks, which have suggested themselves to me while investigating the subject. We are all prone to retrospection. We look back with a sort of fond remembrance to the years of childhood and youth, and affect to lament for the joys which are gone, never to return. This feeling, however, when it comes to be analyzed, and submitted to the test of critical examination, is found to be in a great measure fallacious. If by any possibility we could have the choice, there are probably very few of us who would elect to change the advantage which he has, for the much lauded pleasures of youth. Would any of us be willing to give up the endearments of our homes, our valued friends, the knowledge and experience we have gained in all our battles with the world, and the numerous other blessings we each of us have, for the sake of going back to the frivolous pleasures of childhood and youth, which after all, were not the unalloyed pleasures which we are apt to fancy them, when they are left a few years behind. If we search our memories, we shall find, that we all had our troubles, our crosses, and our disappointments in youth, as well as now, equal perhaps in number, if different in kind; and if we come to strike the balance, it certainly ought to be in favour of what we are, and not what we were. Now, it is just the same feeling which throws such a halo of romance around what are called the good old times, and it is equally false and fictitious in both cases. If we look back to the old times, by the light of history, we see little but a succession of wars, murders, and religious persecutions, with tyranny and oppression of every kind. We see the mass of the people of this country in a state of serfdom, or semi-slavery, most of them in the most abject poverty, and frequently dying by thousands of small-pox, famine, and the plague. In

our own county, which perhaps retained more freedom and independence than any other part of England, there was for centuries very little security for either life or property, it being almost the constant theatre of Border raids, rapine, and robbery. If we judge of the old times from the manners and customs of the people, although we cannot help admiring the openhanded hospitality, and the jovial hilarity which characterized all their proceedings, we look in vain for any mixture of the intellectual element in any of their observances. Their celebrations were all, without exception, of the roistering, bacchanalian kind, and even their religious festivals, were often mixed up with, or supplemented by, sports and revels. If we contrast the state of things just described with that of the present, when the humblest individual among us has as much liberty and freedom as the noblest in the land; when any respectable cottager has a score of comforts and conveniences which, a hundred years since, the richest could not buy; when every township has its school, every household its newspaper, every village its library, and every town its mechanics' institute, its literary society, and numerous other facilities for improvement, it seems a curious misnomer to call those the good old times, in disparagement of these. However, having made this comparison, do not let us run away with the idea that the people of old times are deserving of all the blame, and we of all the praise. We must simply go back to the proposition with which we set out, viz.—the manners, customs, and institutions of former times were the best and only ones possible under the circumstances then existing, and we may make this addition to it: that, whereas, our ancestors were rude and uncultivated, because they had no means of culture or improvement; on the contrary, if any of us are contented to remain in the slough of ignorance and sensuality, we have ourselves alone to blame.

JONATHAN OTLEY, THE GEOLOGIST AND GUIDE.

By J. Clifton Ward, Assoc. R.S.M., &c. (Keswick.)

INTRODUCTION.

In commencing this slight sketch of your late fellow-townsman, Jonathan Otley, it may be asked why should I, a south countryman, take it upon me to sing the praises of a Cumbrian whose daily life never extended beyond these mountains? I reply, that our modest hero dearly loved and carefully explored this district over which it has been my privilege to work for more than seven years; that under his hammer the rocks have rung full oft, as under mine; that he loved nature for nature's sake, as I trust I fondly do; that my heart feels drawn out to speak of Jonathan as a geological pioneer in this country, and that, though I be not Cumbrian born, as I might wish, this is not my fault but my misfortune.

OBJECTS OF A BIOGRAPHY.

But why should biographies be written at all? The *work* each man has done has its influence for good or bad upon those he has left behind, whether *he* be remembered or forgotten. The instrument may have been broken up, but the work done is lasting somewhere, though maybe hidden from sight by all that surrounds it and unites with it. All this is true, but are not our minds so constituted that we cannot look upon a thing *done* without going back in thought to the doer, and this because man is essentially a *doing* animal. Hence not only work accomplished, but the modes of working become profoundly interesting and important to us. We are not content to see the mighty steam-engine speeding along our iron roads, but we must follow back to the child Watt, seated in his

cottage home, holding a spoon at the kettle mouth, making his first experiment on the condensation of steam. We marvel at the speed of the electric message, and our thoughts journey back through a crowd of earnest workers to Galvani making experiments on the frog's limbs. We are lost in wonder at the calculations of modern astronomy, and then stand before the early and self-made telescopes of a Newton and Galileo with child-like surprise. We allow our minds to wander through the vast field of the modern science of geology, and then think of old William Smith, or Strata Smith, as he was called, the land surveyor, making his observations on the lie and position of the rocks while digging his canals and making his bridges. Thus, again, do I, having investigated the geology of this immediate district as none before me has ever had the happy opportunity of doing, look back with pleasure to the pioneering work of Jonathan Otley, the quiet, nature-loving, simple-minded, modest old guide.

One object, then, of a biography, is to make us familiar with the facts as to *how* the work was done, that by the proper exercise of our judgment we may be the better enabled to do our own work, walking both in present and in past light. A second object is, by linking our own work to the past, to prevent our thinking more highly of ourselves than we ought to think. I can fancy many a distinguished astronomer standing before Newton's early telescope in the Loan Exhibition of Scientific Apparatus, and judging his own work to be *very very* small in the light of Newton's work and Newton's instruments.

A third object in biography should be to unite our minds with all that is noble and great in the character of past generations, as we would wish to mix with the intellectual and pure of mind at the present day.

A fourth useful purpose which biography serves is that of encouragement to the worker at the present time. Does the way seem steep and arduous? think of those who traversed it joyfully and successfully, when perhaps far worse shod than yourself, or ere life's sign-posts were so numerous or clear as now. Are we discouraged because our work seems unacknowledged? think of that glorious army of literary and scientific workers who toiled on unceasingly, accepting their mission—present

contempt, for a *future* usefulness; who laboured in state prisons, in county gaols, were counted mad by kinsfolk and acquaintance, brought before papal inquisitions, and their search after truth denounced as impious and heretic; of those who laid the foundations of some mighty discovery in a cottage or a work-shop, who made the garret or solitary spot on the mountain side more sacred and royal than the Queen's council-chamber, because here alone, unfriended, with no words of sympathy, no outward helps, were laid the key-stones of many an edifice which shall stand while royal palace and the proudest earthly buildings crumble away, till the scattered grains of truth which man can collect are all merged in the boundless sands of a truthful eternity. As Longfellow has so beautifully sung :—

"Lives of great men all remind us
We can make our lives sublime,
And, departing, leave behind us
Footprints in the sands of time;

Footprints, that perhaps another,
Sailing o'er life's solemn main,—
Some forlorn and ship-wrecked brother,
Seeing, shall take heart again."

With these words of preface I will address myself to my pleasing task—many kind friends have come forward to help me. First, I must mention the name of Mr. J. Otley Atkinson, of Kendal, nephew to our hero, who has most generously placed letters and papers at my disposal. For further details, many of them of a personal character, I am indebted to Mr. J. F. Crosthwaite and others.

JONATHAN OTLEY'S ANTECEDENTS.

Otleys have lived in the parish of Grasmere for fully two centuries and a half, and Mr. Otley Atkinson thinks he can trace them back to the year 1575, the earliest date of register in this part of the country, while it may be remembered that the oldest register in England goes no further back than 1525. The following copy of entries from the Grasmere register have been kindly furnished me by Mr. O. Atkinson.

1662. Marriage of George Otley and Agness Harrison, 21st of June.

1662. Chris : of Michaell Otley, sonne of Edward of Gressmyre. Novr. 24.

1732. Burials. Jane, wife of Edward Otley of Great Langdale, was buried September the tenth day Ano. Dni. 1732.

1732. Barbary, wife of John Otley of Grasmere, was buried December the third day, Anno Dom. 1732.

1762. Banns of marriage were published between Jonathan Otley, Basket Maker, and Jane Satterthwaite, Widow, on the 28th of March, the 4th and 11th days of April, 1762, by me John Wilson, Curate.

The aforesaid Jonathan Otley and Jane Satterthwaite, both of this parish, were married the 25th of April, 1762, by a Certificate to Langdale by Richard Steele, Curate there, in the presence of Christopher Grigge and Edward Ottley.

1763. Chris : March 3rd, Edward the son of Jonathan Otley of Loughrigg fold.

1766. Chris : Feb. 11, JONATHAN, the Son of Jonathan Otley of Nook House, Loughrigg.

1768. Chris : Novr. 22, Jane, daughter of Jonathan Otley of Nook House in Loughrigg.

1792. Burials. April 26, Jonathan Otley of Scroggs, Loughrigg.

1794. Married. Mr. Robt. Rigg, of Lamplugh, in the County of Cumberland, Schoolmaster, and Jane Otley of the parish of Grasmere, Spinster, were married in this Church by Licence this 1st day of Novr., 1794, by me, Edward Rowlandson, Curate, in the presence of—

Robert Newton.	Robt. Rigg.
Sarah Newton.	Jane Otley.

1808. Burials. March 12, Jane Ottley, of Scroggs in Loughrigg.

It would seem that Nook House was the old name of Scroggs, where our Jonathan was born, and the change made can scarcely be said to have been on the side of euphony. Jonathan's mother, widow Satterthwaite, had been a Grigge, and one of the witnesses of the marriage was her brother, Christopher Grigge, while the other was Edward Otley, probably brother to the bridegroom. Jonathan, the geologist, was born Jany. 19th, 1766, and christened on Feb. 11th. As both he and his brother (who was in the army) died unmarried, the name of Otley is now extinct. His only sister, Jane, was married to Mr. Robt. Rigg, of Lamplugh, in 1794, and died in 1851, aged eighty-two years.

SCHOOL-DAYS AND EARLY LIFE. 1766—1791.

Jonathan's father, who was by trade a wood-sieve and basket maker, seems to have been a man of superior education and tastes; he was a good Latin scholar, and encouraged his son in the study of both Latin and mathematics. Jonathan's school-days were spent partly at the Langdale school, then taught by the Rev. R. Steele, and partly at a good school at Ambleside.

From his school-days until his twenty-fifth year, Jonathan dwelt with his father at Scroggs, working with him in the making of wood-sieves, baskets, etc. He also cleaned all the clocks and watches in the neighbourhood, and showed himself very skilful in engraving upon copper-plates, seals, and coins. Connected with this last act is a story which relates to this part of his life, before he left Scroggs to live at Keswick. Jonathan was in love with a young woman named Ann Youdale, and he engraved their names together upon a silver coin. But unfortunately, the village blacksmith (Mr. Bowness) was also a suitor for the maiden's hand; and some years after, on his niece (Mrs. Wilson) enquiring of Jonathan how it was that his name and that of Ann Youdale were engraved on the same coin, he replied, "Oh, the blacksmith beat me." Clearly the smith understood the value of striking the iron while hot, while our friend's geological hammer had scarcely as yet been wielded.

It is probable that business reasons induced him to move to Keswick in the year 1791. From this time we hear no more of love-suits, and the geologist and guide were wedded solely to nature and the hammer.

Before moving to Keswick, his acquaintance with Mr. Peter Crosthwaite began on this wise. Jonathan, standing outside the Crosthwaite Museum, was accosted by its founder and asked if he would sell a curious stick he held in his hand; Otley asked a shilling for it, the proprietor of the Museum stipulating to show him the collection over bargain; from this time congenial tastes drew the two together as firm and staunch friends.

KESWICK LIFE. 1791—1856.

We now enter upon Otley's Keswick life, which lasted for a period of sixty-five years. He first lodged at Brow Top, and his little shop-

window even now looks out upon the old coach-road. His host's name was Younghusband, and Jonathan was wont to relate, as showing the difference in the cost of living between then and now, how he paid what was considered very handsome for his board, viz.—one shilling a day; and when he remarked to Mr. Younghusband that he ought to throw the Sundays in, his host replied, "No, no, man; we boil the pot on Sundays!"

Mr. Crosthwaite has supplied me with a copy of a memorandum in Otley's hand-writing, showing his board and lodging expenses for a period of sixty-one years and one week, as follows :—

[Memo. in Mr. JONATHAN OTLEY'S Hand-writing, copied by J. F. Crosthwaite].

BOARD AND LODGINGS. Quarto Ledger, p. 6.

Oct. 8, 1791 to 1797	At Mr. Dawson's, Brow Top, 5½ years at 4/8 and 5/- per week	£67	0	0
To 1807	At John Robson's, 10 years at 6/- & 7/- per week	164	0	0
To 1839	At Sarah Clark's, Board only, at 8/4, 9/-, and 10/- per week	746	0	0
To 1842	At Mrs. Richardson's, 3 years at 10/- per week ...	78	0	0
To Oct. 18, 1852	At Richard Burgess', 10 years and 10 weeks at 10/- per week	270	0	0
	Total: 61 years, 1 week	£1325	0	0

RENT OF ROOM.—(Paid to Geo. Rookin and the Rev. John Todd.)

1797 to 1826, 29 years, at £2/2, £2/5, and £2/10	£70	0	0
To 1853, 27 years, at £3/10	94	10	0
Total: 56 years	£164	10	0

Otley lived at Brow Top for five-and-a-half years, and then removed into the town, where he commenced business as a watchmaker, and was for a long time the only one in the neighbourhood.

Jonathan is now in his humble lodging in Keswick, called "Jonathan Otley's, up the steps," watch-mending, making his observations on lake and mountain-side, and year after year becoming more sought after for his practical guidance and fund of local information by such eminent men as Airy, Dalton, and Sedgwick. Mr. Crosthwaite supplies me with

the following notes:—Mr. Otley was naturally shy, which he attributed to his living so long in the country. But he was of a quiet, reserved turn. He was a reader, a thinker, and a listener, rather than a talker; but, at the conclusion of a conversation, he used to give his opinion in such a manner as to show that he had grasped the whole matter. Mr. Otley was, however, quite fond of society, and especially of some of the ladies of his acquaintance. He would go to a pic-nic to have tea with a large party of friends, and gaily bring the hostess on his arm into the ring where the cloth was spread on the green. He used to go every year to visit his native place, and stay there two or three weeks. He said it was not much holiday, for all the watches far and near came in from friends for his manipulation.

The earliest letter that I have seen in Otley's hand-writing, is one written on July 10, 1812, to Dr. Dalton, the world-famed chemist. I will give you some quotations from it, as it at once shows his habit of careful observation, and love of accuracy of detail:—

Thinking it might be acceptable to you to have some account of my excursion to Great Gavel, I have taken the liberty of sending you the following particulars. Thirty-seven minutes after parting, I saw you upon the high ground about the level of one of the Langdale Pikes, you were then turning to the right. Without meeting any difficulty, I arrived on the top of Gavel about a quarter past eleven, and was agreeably surprised to find there a triangular cavity in the rock of about two feet the longest side, and containing about two gallons of clean well-tasted water, of the temperature of 71°, the air ranging from 63° to 66° out of the sun; the deepest part of the water did not exceed four inches; its surface was about two inches below the brim of the cavity, and I could not perceive any running in or out. I lowered it about a quarter of an inch by drinking, and did not find it to rise again. There is a little earth in the interstices of the rock, but I think there is not more of it above the level of the well than might be carried in a wheelbarrow.

The summit of Gavel is something like Scawfell but more pointed, of irregular broken rock. There is not an area of more than eight or ten square yards above the level of the well, and the highest point of rock is only two feet above the surface of the water.

I remained on the top two hours and a half, and though the clouds frequently varied their shapes and permitted me to view different objects, I was rather

disappointed in not being able to see the top of Scawfell, where we were the other day. I observed one of the pikes of Broad Cragg, or whatever it may be called, (I think it should have a more distinguishing appellation,) far above Gavel, with Greatend, the difference is scarcely perceptible. Helvellyn is above the level, and Skiddaw very little more than what may be allowed for the curvature.

I left the hill a little before two, and by a rather rugged descent, found the way to the Blacklead mines, where I rested a while. I arrived well at Keswick in the evening; the barometer had risen during my absence about the eleventh of an inch. I hope you and your companion arrived safe at Kendal.

(See also further correspondence on the subject of the Well with Sir G. Airy.)

Another letter to the same celebrated chemist gains additional interest from its being one of the earliest intelligent accounts of the Floating Island, and, as subsequently noticed, some of its particulars were afterwards published in the Memoirs of the Manchester Philosophical Society.

September 14th, 1815.

Mr. Dalton,—

I received yours of the 8th, and much obliged to you for the analysis of the gas. The books for Mr. Knight shall be duly forwarded.

Derwent Lake varied very little in height for about a month after you saw it, which was unusually low for such a length of time. About the 6th day of August, the Floating Island began to appear above water. I was upon it on the 21st, at which time the lake had risen about eight inches, and the Island was only about four inches above the level of the water; its length was eighty-eight yards, its greatest breadth twenty-five, but some part of it less than half that. The gas on coming up had then a very perceptible smell, which I compare to that of a foul gun. Whether this smell is stronger when the Island first emerges, or whether when the Island is sunk the smell is taken away by the greater depth of water through which the gas ascends, I am not able to determine. I endeavoured to ascertain whether the Island consisted of the same peat earth throughout, which I find to be nearly the case; and also to examine more particularly the earth underneath it, which I have been inclined to call a Vegetable Oxide. On taking up some of this at the depth of thirteen feet from the surface, I found it intermixed with specks of a bluish green colour, which from its turning black with infusion of gall, I take to be Sulphate of Iron; this makes me suspect that in my hypothesis of the generation of the gas, I may have laid too much stress upon the decomposition of vegetable matter in the Island, or could the Iron be originally contained therein?

The gentleman who brought the book having kindly offered his services to take

you anything I might wish to send, I embrace the opportunity of sending you a small specimen of the earth of the Island taken from the surface, a small one taken at its under surface, and a larger specimen taken from below the Island, part of it at the depth of thirteen feet from the surface, that is, four feet below the water under the Island; you will find this when dry to be uncommonly light. The Island never appeared to rise so high above water this season as it did in 1808, and on the 1st of September, the lake having risen about two feet, it was entirely covered, and has not appeared since.

From this time forwards, Otley receives numerous applications for various objects of natural history, and for very varied items of natural information. Thus, in 1824, Wm. B. Clark sends payment for minerals sent, and adds—"The price you have fixed, forty shillings, appears to me to be too little, I have ventured to make it fifty shillings."

The following letters from Dr. Pearson and Dr. Henry give us a glimpse of Jonathan the guide, and how he was treated by tourists of half a century back.

From Dr. Pearson.

Globe Inn, Cockermouth.
August 25th, 1826.

My dear Sir,

Mrs. Pearson and myself, in common with our daughter, Mrs. Moffat, regret exceedingly that the little irritation produced by the hostler at the moment of our departure prevented our taking a friendly leave of you, as we intended; and we beg to offer you our united thanks for your great civility and attention during the day, as well as for your valuable present, one half of which my daughter has already read to us in the carriage, which afforded us much pleasure. You have arranged your ideas very methodically, and have expressed yourself in sensible and significant language, and we shall peruse the remainder, I dare say, with equal pleasure. The ladies desire to be kindly remembered with, dear sir, your very obliged and grateful friend.

W. Pearson.

P.S.—Since writing the above, I have discovered that I left a silk red and yellow handkerchief in the dinner room at the Inn, which I used for the pocket, and which is consequently dirty; I will thank you to enquire for it, and if it should be found, which I hope it will, I beg you will accept of it, as a trifling

mark of my respect, when you have first got it washed. You may show this to the landlady, who will no doubt cause enquiry to be made of the waiters.

(Written outside the wrapper.)

As I have found the dirty handkerchief in a side pocket, I beg leave to substitute a clean one for your acceptance.—W. P.

From Dr. Henry.

Manchester, October 5th, 1832.

Dear Sir,—

When I parted with you at Ambleside, I regretted that I was prevented (by the limited remains of my finances, which I calculated would barely allow me to discharge a small debt on the road and pay my expenses home,) from doing what I then felt, and now on reflection still more strongly feel, to be an act of justice towards you. You were kind enough to place the accompanying of me on my several excursions on a purely gratuitous footing, but I cannot reconcile it to myself to take advantage of your liberality, and beg that you will do me the great favour of accepting the enclosed. I offer it by no means as a compensation for your services, and I shall still hold myself indebted to you for a fund of valuable information, much of which I could not without your assistance have obtained at all, and the rest of which, if I had been left to myself, must have been purchased at a much greater cost of time and labour. By your kindness I was put in possession of knowledge on the soundness and accuracy of which I can fully rely, not without a great sacrifice of your time, and on some occasions not without personal fatigue, which I felt concerned that you should encounter.

I should have written sooner, but have only just been able to procure a frank. You will favour me with a single line that I may know this reaches you.

Believe me, dear Sir, yours obliged,

William Henry.

P.S.—Mr. Dalton desires his best regards. He is quite well. Please to tell Mr. Wright that Mr. Gilbertson, druggist, of Preston, is still living. Will you allow me to trespass upon you for a shilling to the letter carrier whom I forgot.

Among the many letters addressed to Otley as a guide and collector, there are some asking for flowers, there are others for information about such matters as mineral veins, water, soil, the names of mountains (from Lieut. Murphy of the Ordnance Survey), the floating island (correspondence with Dr. Dalton), cleavage of the rocks (from Professor Phillips), state of the wind, helm and bottom winds, the well on Great Gavel

(correspondence with Sir G. Airy), the meaning of words, and questions about lost people.

A few extracts from some of these letters will suffice to show how Otley was employed, and how he was thought of by those with whom he came in contact.

In 1818, Otley corresponds with Mr. Greatorex of Portland Place, who sends him the heights of several stations visited by them together, as calculated from their barometrical observations, giving at the same time the details of his calculations.

Throughout his long life he interested himself in the heights an names of mountains, and the two following letters bear upon this point, the one by Otley being written in his eighty-ninth year.

From Captain Gosset.

Ordnance Map Office, Southampton,
March 26th, 1853.

Sir,—

Your note relative to the datum plane for the Levelling of the Ordnance Maps has been forwarded to Colonel Hale, R.E., by whom I am directed to reply to your questions.

The datum plane is *mean* line of the Sea Level (obtained from a large number of tide observations) at Liverpool. The six-inch Ordnance Survey began in Lancashire, therefore Liverpool was selected. The *mean* line has been adopted because it is the most steady point in Tides. The mean between a High and Low water mark at a *Spring Tide* is *nearly* the same point as the mean between High and Low water mark at any other tides taken by pairs of tides.

You are coloring some of the contours; permit me to remark that to color those of the *same* altitude *one* color, those of a second altitude *another* color, and so on, gives information to the eye from end to end of a sheet at a glance.

Your obedient servant,
W. Driscoh Gosset,
Captain R.E.

From Mr. Otley to Captain Gosset.

Keswick, July 13th, 1854.

Your kind letter of March 26th, 1853, in answer to my enquiry respecting the Map of Coniston Fells, I am emboldened to offer to your notice a few of the observations that I have made on the subject, chiefly relating to names. I am glad

that the conductors of the Survey have preserved the established names, rather than inventing new ones, following our learned antiquarians into obscurity.

I am aware of the difficulty of obtaining local names from the inhabitants of a district, they are sometimes reserved in speaking out; but if you find a party of Fox-hunters enjoying themselves, that is the time to obtain the local pronunciation of names of mountain rocks. As to spelling, in reports of Fox-hunting, we find great Oukrigg, and Hookriggs. In some districts, the termination crag is pronounced as crig, so in the map, it is How Crags. From infancy to manhood, my every-day prospect, from the Scroggs, where I was born, was Weatherlam and the twin Carrs, with the Old Man just peeping over the shoulder of the former. The Carrs we found to be higher than Weatherlam by the clouds first touching them; and when a cloud settled upon the Carrs it was generally the forerunner of a shower commencing in Greenburn. One of these was the Great Car, and the other situated between that and Weatherlam, at the junction of Prison band and Swirl band, with the top of Broadslack, being nearly equal in height to the Old Man, and wanting a name, I should call it High Carr. These, with the Little Carr, Mr. Green in his assiduously compiled guide calls the Langdale Carrs; and Black Scar with How Crags he calls the Coniston Carrs.

The word Carr I take to be synonymous with Scar, which I formerly defined as an escarpment or range of rock; I cannot now tell how I got the word; but I have since found that Mr. Richardson, in Wordsworth's guide, had adopted it. In Westmorland we have Flammar Scar, Orton Scar, Nab Scar, Scout Scar, Whitbarrow Scar: I do not know why we double the *r* in Carr, any more than in Scar, or the *g* in Crag. I should write Little Car, Great Car, High Car in the singular, and in plural the Carrs.

In some districts the termination crag is pronounced as crig; so Long Crag is made into Lankrigg, and How Crags is converted into Hookriggs. An artist that I employed to make a sketch for me, imitating the pronunciation, wrote it Great Oukrigg.

I should write Great How Crag, Little How Crag, and plural How Crags. Much has been said of the derivation of the name "Old Man," which had been originally applied to the pile of stones on the summit, and has since been extended to the mountain itself; but if I had to speak of climbing *the old man*, I should rather think *to the old man* a more correct expression. With respect to Hen Crag and Hen Tor I have little to say; we called it Hen Teah: I suppose from a fancied resemblance to the toes of a Hen's foot, and Mr. Green intending as an improvement, wrote it Enfoot Crag.

Doe Crag, as wrote in the map, is pronounced Dow Crag, and Mr. Gibson, author of "The Old Man," a neat and entertaining volume, writes it Dow or Dhu Crags.

"Thus motionless, and moanless drew
His parting breath stout Roderick Dhu!"
Lady of the Lake.

I have been supplied with two small sheets of explanation, yet still there are some initials and signs, and in one or two places the word "bolt" of which I cannot make out the signification.

N.B.—The figures on Great How Crags 2625 should be 2525. I hope you will excuse the liberties I have taken with the work which had afforded me a great deal of pleasure. Now in my eighty-ninth year I am not able to climb the hills, so I must content myself with them represented on paper in a way I had not expected. If you find anything deserving a reply, I should be glad to receive it from you.

Yours, ———

The following letter from Mr. Farey, the well known old mining engineer, is of considerable importance.

From Mr. J. Farey.

37, Howland Street, Fitzroy Sq.,
March 14th, 1819.

Dear Sir,—

The bearer, Mr. Wilson Lowry,* is my particular friend; he is a native of your country, but left it very young, and has long resided in Great Titchfield Street (No. 57), very near here;—he is not less known, as the unrivalled Engraver of perspective and scientific subjects, than as a most able Mineralogist, Crystallographer, &c., &c., and having the most extensive scientific acquaintance of perhaps any man in England, except Sir Joseph Banks;—if during the short time he may be able to stay at or near Keswick, you can show him attention, it would greatly oblige me, and the same may eventually prove beneficial to yourself, Mr. L. having often proved himself a liberal recommender of ingenious, practical, unassuming men like you.

I hope that you received my long letter of the 26th ult., and that you will be able to shew and explain to my friend Mr. L. on your map, all the *Lines* of *Strata Ridges* (troughs) and *Strata Partings* which I have described therein; with all such corrections or verifications of them, new ones, etc., as you may have been able to make. Wherever you *actually observe the direction of the Dip*, draw a short *dart* on the place on your map; and if you want to express the different *degrees of Dip*, the most ready and useful mode is, that of the colliers, who always mention the proportion of CB (considered as 1 or unity) to AC; and they say, a coal (as AB)

* Father of Mr. Lowry, the present talented engraver of the Hor. Sects. of the Geological Survey.

"dips 1 in 8 to the NW;" or "dips NW 1 in 8;" that is imagining AC *level*, and 8 of any measure (as inches, feet, yards, fathoms) CB, or the perpendicular descent or fall of the seam in that length, is 1 of the same measure. This I express on my maps, by writing a small 8 at the point of the dart. I hope I shall soon receive a *long letter of new facts and corrections* from you, of the suggestions I have sent to you, as to *the structure* of your interesting District, the *technical mineralogy* of which is rather out of my way, but exactly in that of my friend Mr. Lowry, who may perhaps give you some useful hints, as to *the sale* at or near home (perhaps at Kendal, Penrith, Carlisle, Whitehaven, etc.) of Strata Maps, coloured by you, as I have recommended in my last.

I am, dear Sir,
Yours very truly,
J. FAREY, Senr.

In a second letter, dated March 17th, 1823, Farey asks Otley numerous geological questions, and alludes to Jonathan's first meeting with "Strata Smith," often called the Father of English Geology; he says—"Mr. Smith's conduct, on your first meeting with him in summer, 1821, affects me, much more with shame and regret, than with surprise. Had he met me there, or *any one* else, who he knew had laboured at the "knotty parts" he was examining, he probably would alike have shunned us." . . . Smith and his nephew, John Phillips, afterward the well-known and accomplished Professor, stayed shortly after for some time at the Queen's Head, Hesket Newmarket, having business in connection with the High Pike Mine.

From Mr. J. Farey.

37, Howland Street, Fitzroy Square,
March 17th, 1823.

Dear Sir,—

My apology is due to you for not sooner answering your kind letter of the 12th December, 1821. For some weeks after that date I had not seen Mr. W. Forster's book, and could not therefore immediately understand and reply to your remarks thereon; and in the meantime, I was fortunate enough to be employed by the Commissioners of His Majesty's Woods, Forests, &c., to investigate and report on the *Slate* rocks and quarries in the vicinity of Bangor, in North Wales; which has given me a good opportunity of comparing the stratification there with that which surrounds you in Cumberland: confirmatory of the important fact which you taught me (having myself never seen about the *western half* of your mountains)

viz. that all the Slate Series *dips one way*, with considerable regulariy, instead of exhibiting, either "mantle-shaped" strata, around the great mountain masses, on which Geognosts had so often fabled, or the ridged and troughed structure, which I had supposed, and that the Coal-measures and under-coal Limestones, &c., lap round the denudated edges of your slaty mountains, *unconformably on all sides*, even on the south-eastwards. . . .

From Dr. Dalton.

Manchester, January 15th, 1826.

Dear Friend,—

I received your letter and parcel all safe in due time in October last, and have to apologize for my neglecting to acknowledge it for so long a time. In the first place I was very unwell at the time, being confined to the house for two or three weeks by the most severe cold I ever had, and indeed in a great part to bed. It was accompanied by an affection of hearing I had never before; I was so deaf for two or three weeks that I could not hear the church bells across the street, unless I was out of doors. However, I have since entirely recovered my former state of health.

I wished also to analyze the air before I wrote, which I did as soon as I recovered. I also read the greatest part of your letter at one of our more vacant meetings of the Society, and have to return you the Society's thanks for your communication, as well as my own. Indeed, as soon as I heard of the floating island being astir, I was hoping that you would not let slip the opportunity of some farther observations. If you have not published the substance of your letter, you will perhaps have the goodness to extract what you may think proper for our next volume, which however will not be published perhaps for a year or two.

I examined the bottles of air: the new air and the old were exactly of the same quality, a circumstance to me very surprising: I also had some of the old air left, and they were all found to agree as nearly as could be: a little carbonic acid being washed out, they all yield about half *carburetted hydrogen* and half *azote*, proportions which I never before met with in mixture, though I have found the proportions various. Nothing adverse to your theory occurs from this: but it is wonderful the same proportions should be found as were before.

I examined the air from Helvellyn and Skiddaw. The former was considerably inferior in oxygen to the air below; and the latter a little, but much less than the other. You will remember the atmosphere was changing much about the time from the odd appearance of the clouds the evening we left Skiddaw.

We have just had some severe frost: on Friday morning, the thermometer 16° in town and 4° or 6° in the vicinity; a slight cover of snow and fine clear frost in the country.

I remain, yours truly,

JOHN DALTON.

The following extracts, from letters in connection with the water-supply for Keswick, are of interest, as mentioning Otley's nickname among some of his friends, and showing his power of repartee.

From Wm. Dickinson of North Mosses.*

January 28th, 1851.

Dear Sir,—

When you next come across "Anthony Loajet," be good enough to say I take some discredit to myself for not having made myself acquainted with the fact that the district mentioned in his "bold conception" had ever been proved in the way he mentions. Should my Essay ever require a new issue, his observations shall be duly considered, and such alterations made as the case may seem to require.

Does friend "Anthony" bear in mind that nearly all the little hills and elevations in Underskiddaw have wet crowns, and that the *leck* is very near the surface? so near in some of them, as to be within reach of the plough? Some, indeed many, of the crowns of these hills are of small extent—much too small perhaps to retain water sufficient to keep up the continued oozing they exhibit, giving full allowance to the conjectured equilibrium of gravity and attraction he so opportunely enlists.

From the long continued operations of husbandry, the crowns of the hills must be, and are, becoming bare of soil, and of all other porous covering. Does it not seem reasonable that the supply, constant as it is, should come from below? Pray put a few of these questions to friend "Anthony," and coax him to put his pen to paper again.

I remain, dear Sir,

Yours most truly,

WM. DICKINSON.

To which Otley replied :—

Anthony Loajet is obliged to acknowledge that his ammunition has been exhausted in the first onset; he is unable to prove the solidity of his conceptions, but he cannot divest himself of an *opinion*. As A. L.'s paper has not been published, I hope it will not be the means of interrupting that friendly feeling which has hitherto subsisted between us.

In 1852, Mr. J. F. Miller of Whitehaven, asks for information about the Helm Wind and local phenomena, amongst others, the last time

* Author of a Paper on "The Farming of Cumberland." *Journal of the Royal Agricultural Society*, vol. xiii., p. 207. 1852.

eagles were known in Borrowdale. With regard to this last point, Mr. Miller says—"From J. Dixon I learn that the eagles' nests in Eagle Crag were robbed by W. Walker and W. Youdale in 1772 or 3, and after that they got out a brood in Wything's Crag, above Stonethwaite, which was the last time they were known to build, probably about 1784, as stated in your account."

In 1853 and 4, Dr. Henry of Haffield, Ledbury, applied to Otley for details of Dr. Dalton, which were published in the Life of that celebrated chemist; a letter of Otley's (to be quoted farther on) to Dr. Henry is of interest, as it is written in a beautifully clear hand, and shows how his mind was in activity in his 90th year.

Among miscellaneous M.S. memoranda is the following concerning the inscriptions on the Keswick Town Hall Bell :—

"Many inscriptions nearly of the same age as that on the Keswick bell, with figures in Arabic numerals, are said to have been discovered in diffrent parts of England, as for instance—one at Rumsey in Hampshire, dated 1011; another at Wignall Hall in Hertfordshire, dated 1016; another at Daresbury in Cheshire, dated 1110; another on the rock at Alnwick, dated 1155; another on the tomb of Gilbert de Astlay in Keighley church, Yorkshire, dated 1023; another at Bigland, near Cartmel in Lancashire, inscribed upon a beam, and dated 1161; and another upon Tice's Well, on Dartmoor, dated 1168.

The authorities for some of the above are the Letters of Leonard Atkins; Cooke's Topography of Lancashire, p. 104; Carrington's Dartmoor, in Note 118; Baines's Yorkshire Gazetteer, I. 167, 218; Archaiologia, vol. 113.

It is asserted that Gerbert, who was afterwards Pope under the title of Silvester II., brought this notation from the Moors of Spain into France about 960, and that it was known among us in Britain in the beginning of the eleventh century, if not somewhat sooner. (Nicholson's Encyclopœdia Arith.) Dr. Wallis, in a letter inserted in the Philosophical Transactions (266), shows that Arabic numerals were used in England, Anno 1090. See also Bibliotheca Literaria, viii. 25."

OTLEY'S GUIDE BOOKS.

At present Otley's fame rests mainly upon his early map and guide-book, the first of their kind, and worthy the man in every respect. His mountain outlines are for the most part admirably truthful, and devoid of that sensational exaggeration in which too many artists are apt to indulge. The following are the dates of the various editions of the Guide, with particulars of each as given by Otley himself in 1840, in reply to a letter by Mr. Thos. Sanderson of London.

"In 1817 I constructed a map of the district, which I had engraven and published in 1818. It was chiefly sold as folded for the pocket.

In 1823 I arranged a description of the lakes and mountains, with the stages and other requisites for a Guide, to which were added some essays which I had wrote for the Lit. and Phil. Soc. of Manchester, making together a book of 136 pages; sold at 4s. 6d. in printed covers. 600 copies.

In 1825, a Second Edition, extending to 142 pages. 1000 copies.

In 1827 I reconstructed the map, and had it engraven on a new plate, with considerable improvement, and published Third Editon, 150 pages. 1200 copies.

In 1830, 4th edition, with eight woodcuts, designed and engraved by myself, and eight pages relating to the Botany of the district. 180 pages. 1000 copies.

1833-34, Fifth Edition, with eleven woodcuts, several of them re-engraved, ten pages of Botany, 184 pages and Index. 1200 copies.

1837-38. Sixth edition, twelve woodcuts and copper of my own drawing and engraving, 184 pages + 8. 1200 copies.

When I first published there was no other work that had any pretension to compete with it; now almost every bookseller in the district publishes. By extending some of the articles, and abridging others, it was kept to the same number of pages; and although the Plate is something worn, I am confident it will lose nothing by comparison with any others, especially in the hands of persons well acquainted with the country.

1844. Seventh edition. Large and small cuts of Lake mountains,

—Skiddaw, Helvellyn, Lowdore, Scroggs—twelve or fifteen drawn by Binns, engraved by Jewitt. Lonsdale and the caves, and a new map.

1849. Eighth edition. Plates same as the last, with Druid's Temple. 216 pages. 46 Illustrations. 1250 copies.

OTLEY AS A GEOLOGIST.

But Jonathan Otley ranks far higher than a mere guide-book maker, He was most decidedly the pioneer of Geology in this district; and as the one who laid the first stones upon which Sedgwick and others have built a superstructure, we owe him all honour and thanks. His writings are not numerous, nor is this to be expected; but whatever he did write he wrote with much care, and always plainly to the point, and with great good sense. The following is a list of his various writings:—

1819. Account of the Floating Island in Derwent Lake, Keswick. —*Mem. Lit. & Phil. Soc. Manchester.* Ser. 2, vol. iii., p. 64.

1819. Account of the Black Lead Mine in Borrowdale.—*Ibid* p. 168.

1820. Remarks on the Succession of the Rocks in the District of the Lakes.—*Phil. Mag.* vol. lvi. p. 257. (From the *Lonsdale Magazine*, vol. i. p. 433.)

1823. A Concise Description of the English Lakes and adjacent Mountains. 8vo., Keswick, 6th edition in 1837; 8th edition in 1850, with Portrait and Memoir.

1831. Further Observations of the Floating Island of Derwentwater, with Remarks on certain other Phenomena.—*Mem. Lit. & Phil. Soc. Manchester.* Ser. 2, vol. v., p. 19.

The earliest of Otley's written works seems to have been a paper read before the Manchester Philosophical Society on December 27th, 1816, upon the Black Lead Mine, in Borrowdale, and published in their Memoirs in 1819, together with another paper upon the Floating Island in Derwent Lake. The former paper is dated Keswick, November 28th, 1816, and is a careful and trustworthy account of all that was then known of the Mine.

In 1823 Otley first introduced Sedgwick to Cumbrian geology, their

first excursion together being up the river Caldew from Mosedale. Dr. Leitch, in his short memoir, quotes Otley thus, regarding this excursion; "when I proposed to return, Mr. Sedgwick threw off his coat and went on: I went across and showed him where granite appeared near the foot of Willey Gill." This was the commencement of a true friendship which lasted unto the end; each trusted the other completely, and ascribed everything done to good motives; both lived to a very advanced age, and left behind the memory of well-spent lives.

The paper entitled "Remarks on the Succession of the Rocks in the District," first attracted the attention of geologists to our Cumbrian mountains; and Sedgwick pointed out to the Geological Society of London, in 1831, how that Jonathan Otley had been the first to recognize that "the greater part of the central region of the Lake Mountains is occupied by three distinct groups of stratified rocks of a slaty texture." These groups Otley first called the Clayslate, Greenstone, and Greywacke divisions, the first representing the Skiddaw Slate, the second the Volcanic Series of Borrowdale, and the third the Coniston Limestone and Upper Silurian of the southern part of the district. This threefold classification of the rocks of the mountain country forms the basis of all geological work in the district; and thus did old Jonathan lay the foundation stones of the future building.

Again in 1836, Professor Sedgwick, in his paper to the Geological Society, entitled, "Introduction to the General Structure of the Cumbrian Mountains," after describing the various subdivisions of the altered slate rocks around the Skiddaw granite, says "we owe our first accurate knowledge of these subdivisions to Mr. Jonathan Otley of Keswick, who not merely described them in general terms, but gave their geographical distribution with a very near approach to accuracy."

In 1835 we find Jonathan in communication with Professor Phillips, then curator of the museum at York. Besides his observations upon the larger divisions of the rocky series of Cumbria, he had been noting such matters as the distribution of boulders and the character of the red conglomerates of Kirkby Lonsdale and Mell Fell. The following letter from Professor Phillips is dated York, November 25th, 1835.

From Professor Phillips.

Dear Sir,—

I am much obliged by the receipt of your notices concerning the distribution of Boulders from various parts of the Cumbrian Mountains, which are very satisfactory, and will be incorporated in a general view which I mean to offer to the next meeting of the Association, of the Phenomena of this nature in the west of England.

I have also been much gratified by the specimen of red crinoidal limestone from the "Old Red" Conglomerate of Kirkby Lonsdale. In my long residence at Kirkby Lonsdale, I also found Limestone fragments in that singular rock, and experienced exactly the same hesitation as to its geological place.* These doubts I have discussed at length in my new volume on Yorkshire Geology, now passing through the press, and from the whole of the evidence at this and the other stations where that rock occurs, I conclude it to be of the Old Red *as the most probable of the possible results*, but I know no one instance of real and actual superposition, except perhaps at Dacre Castle. There are absolute and good arguments for this antiquity, and perhaps none positive against it. The Limestone is puzzling, however, and so I always thought it.

Can you give me a notion of your results as to the *general direction of slaty clearage* in your country? I mean as compared to the *E. W. N. & S.*, also as to its relation to the planes of stratification; is it rectangled to them, (not quite I think); have you noticed any general directions to the joints, fissures, or "Backs" in the slate? is there any "bate" besides the clearage, (as we have in Craven always)?

Ever yours truly,

JOHN PHILLIPS.

This last question addressed to Otley, by Phillips, regarding cleavage, brings me to notice what I cannot but consider the best piece of geological work ever done by Otley, and that by which he ought to be known by all English geologists. No one with even a slight knowledge of rocks, can fail to see the difficulty which frequently attaches itself to the distinction between bedding and cleavage in such highly contorted strata as those of the Skiddaw Slates. The bedding lines are those of original deposition, and are frequently marked by bands of slightly different colour, (called *stripes* by the old writers), but the planes of cleavage which frequently cause the rock to split readily across the bedding have been produced, subsequently, by great lateral pressure, the particles of the rock being made to take up new positions, and being

* In former letters Otley had, from the presence of such fragments of limestone in the Conglomerate, doubted whether the latter really underlaid the Carboniferous Limestone.

lengthened along the cleavage planes thus produced. If the planes of cleavage are mistaken for those of bedding, errors of the most serious character might arise in working out the structure of a tract of country. Hence, the man who first clearly pointed out the difference between these two structural planes, did a great and worthy work, which should receive its due acknowledgment from the after-workers. And this did Jonathan Otley.

Professor Phillips, in his exhaustive Report on "Cleavage and Foliation in Rocks," published in the British Association Report for 1856, page 369, thus mentions Otley's work.

"The earliest notice of a real and firm distinction between cleavage and stratification, derived from English examples, which I have met with, is in Otley's 'Concise description of the English Lakes' (Keswick 1823, an earlier publication in Kirkby Lonsdale Magazine, 1820). He speaks of the beds of slate with frequently vertical cleavage, and adds—'*but it is found in various degrees of inclination, both with respect to the horizon and planes of stratification.*' Sedgwick, in 1835, defined the character of slaty cleavage, the fundamental generalization, due to him, is that 'cleavage is a peculiar structure impressed on certain rocks, and in certain regions, by the operation of some very extensive cause, operating after the stratified rocks had undergone great displacement.'"

With these remarks on Otley's geological work, I am content to leave his character as a geologist. His observations on various points of geological detail were numerous and important, but his position among English geologists of note will ever rest upon his work in the first classification (into three divisions,) of the rocks of the Lake District, and in the first drawing attention to the fundamental distinction between cleavage and bedding. Jonathan Otley worked according to his light, and used the talents given him, in a quiet, unobtrusive manner, which bringeth its own reward, even that of a contented and happy spirit, joying in the works of nature.

As a further illustration of Otley's work, and the estimation he was held in by Professor Sedgwick, the following series of letters are of great interest. They date from the year 1827 to 1855, the year before Otley's death at the advanced age of ninety.

From Professor Sedgwick.

Trinity College, Cambridge,
February 9th, 1827.

Dear Sir,—

Since I had the pleasure of seeing you at Keswick last September, I have made very little progress with my geological papers. A public examination, and a course of Lectures to the University, took up the greatest part of my time in the October Term; and as soon as it was finished I started for Paris, at which place I remained five weeks; employed among other things in studying the public collections of that capital. You would have been at once delighted and astonished at the magnificent fossils and other specimens of natural history in the Parisian museums. In about a fortnight I hope to finish the work which I have at present on hand; and I shall then commence with arranging my Cumberland collection. If you have finished the map of the Skiddaw region, have the goodness to send it up along with my own geological map, by some safe conveyance. The mail is, I think, on the whole, the safest—more safe than a private hand. I don't regard any expense of carriage, it would therefore perhaps be best to make it into a moderate sized parcel. Pray send at the same time your own account, and I will transmit the money by the very first opportunity. Cowper is here with a large assortment of minerals, but I have not yet seen him. How is C. Wright getting on? Present my kindest remembrances to Mr. Southey, and believe me with great regard,

Very truly yours,
A. SEDGWICK.

P.S.—Your own reputation is quite safe in my hands. I will carefully describe in my paper all those facts and details, which I derive from yourself and from your prior publications. And I shall adopt with proper acknowledgment, your three great divisions of the Slate formation.

From Professor Sedgwick.

Deal, October 5th, 1827.

Dear Sir,—

I received your map and letter some time last Spring, and hoped to have found an opportunity of sending to you; but I started for Scotland before our men left College, and have since that time been scrambling among the Highlands of Scotland and the Hebrides. Dr. Ainger is commissioned to pay you five pounds; not as a remuneration, but as an acknowledgment for what you have done for me in perfecting the map of the Skiddaw region. I am quite sure the sum is not adequate, but the employment was one which I believe you do not dislike; and perhaps in some future year I may again look for your assistance in a friendly way. I hope in course of next year to complete a description of a portion of the Cumberland mountains. I shall also endeavour to draw up an account of what I have seen in Scotland.

The conglomerates of the Old Red Sandstone are developed upon an enormous scale in the Highlands, composing whole mountain ranges. I traced them from the Hebrides by the north-west coast round Cape Wrath, and along the north and north east coasts as far as Aberdeenshire. They then run on the south side of the Grampians, and gradually slide down under the coal measures of Fifeshire and Stirlingshire. If you have any geological news to tell me, I hope you will write to me at Cambridge, where I expect to be next week.

Believe me, my dear Sir,

Very truly yours,

A. SEDGWICK.

From Professor Sedgwick.

Trinity College, January 26th, 1828.

My dear Sir,—

I was much obliged by the receipt of your plan of the mountains, etc., near Buttermere, and shall endeavour to turn it to some account. But I shall hope to see you during next summer, and we may perhaps be enabled to make a short excursion together.

I know you were *formerly* sceptical about the conglomerate of Mell Fell, etc. Now the fact is—that it appears just where you would expect it if it were inferior to the mountain limestone—that it contains no pebbles of that rock—that close to Shap Abbey, and in one or two other places it is actually seen under the limestone. It may in some places contain concretions of limestone, which might be mistaken for pebbles. If this be the case, it resembles the old red conglomerate of the west of England, which has subordinate calcareous stony concretions sometimes in large beds, which are worked for the roads, and called cornstone. Wherever I have seen the new red conglomerate near the mountain limestone, it has been half made up of that rock.

I have lately been reducing my observations on a part of the Hebrides. I am now finishing a paper on the Magnesian limestone which I have had on hand for years. On comparing my results with the observations in Central Germany, I find the agreement between the contemporaneous deposits more exact than I ever expected The great sub-divisions are nearly the same, and the fossils are almost identical.

As soon as I have finished what I have in hand, I mean to attack the Skiddaw region, with the help of your beautiful map. The mineralogy I however find extremely perplexing and difficult. I had a copy of your Map of the Lake District, but I have mislaid it; would you have the goodness to send me your latest edition of it. You may send it, and direct it as a letter. I will pay you for it when we meet. Present my respectful remembrances to Mr. Southey, and my best wishes to Charles Wright.

Very truly yours,

A. SEDGWICK.

From Mr. Otley.

Keswick, January 30th, 1828.

Sir,—

I am much obliged by your explanation relating to the conglomerates ; I am not sufficiently acquainted with them myself to form any very strong opinion, and I did not know that this of Mell Fell had actually been observed to pass under the limestone. Two or three questions naturally suggest themselves.—From whence have the included pebbles been derived? Have they travelled from the fells of Orton and collected the calcareous and ferruginous matter by the way, or have they once existed as a bed of Gravel, and been afterwards conglomerated by the infusion of calcareous tufa? and what became of the surplus when Mell Fell was rounded into its present shape? I was at a loss to guess. I do not know that what I have taken for limestone pebbles are to be found in Mell Fell; I think I found one in the Conglomerate, near the foot of Ullswater: from their greater frequency in that at Kirkby Lonsdale, I thought it might have been of somewhat later formation, and I almost imagined that I saw where it had rested *upon* the Limestone at the foundation of Kirkby Lonsdale Bridge: however, this certainly bears no resemblance to the *Brockrem* of Kirkby Stephen, of which Wright has brought me a specimen only last week.

I have not had an opportunity of seeing the Old Red Sandstone, on which, "in its common form of a coarse pudding-stone," the lowest stratum of the great escarpment of the great limestone series of Cross Fell is said to be incumbent from Melmerby, to High Cap, near Marton.

In the map of Skiddaw, etc., which I sent you, I believe I made a small mistake in a part where I ought to have been best acquainted. On the South side of the mountain, Bargill should have been made to join Howgill, before it crosses the Turnpike road; instead of joining Gale Gill, which enters the Derwent at a different place.

C. H. Wright is obliged by your kind remembrance; he is preparing to set off for Oxford with a collection, in consequence of an invitation from some young Collegians last Summer, and you may probably see him at Cambridge before his return. I have the pleasure of sending you a copy of my new Map of the Lake District, and shall be very happy in making an excursion with you in the ensuing Summer.

I am, Sir,

Your humble Servant,

JONATHAN OTLEY.

From Professor Sedgwick.

Trinity College, Cambridge,
October 29th, 1836.

My dear Sir,—

I am just returned from a geological tour of nearly four months in Devonshire, Cornwall, and Pembrokeshire; and I have now brought to a close a series of observations on the older strata of England, which I began in 1822. When I shall be able to get my observations down on paper I hardly know; as new matter is continually rising up, and my health when I lead a sedentary life, is never very good. When I began my work in Westmoreland, (the year before I became acquainted with you at Keswick) I was puzzled to death at first by the appearance of three parallel systems of planes, traversing many of the coarse upper slates. These were *joints, cleavage planes,* and *beds.* But which were the true beds? I found them to be indicated by the stripe and other appearances not easy to describe. I also find among my old memoranda a notice of two sets of *master-joints*: one set I call *dip joints,* because they are nearly transverse to the beds, and therefore coincident nearly with the dip—another set, *strike joints,* nearly at right angles to the former, and therefore nearly in the direction or strike of the beds. Unfortunately during subsequent years, though I often remarked the *joints* and the rhombohedral solids into which they often divided the slate rocks, I never noted their *direction* by the *compass.* Now during the past summer, I have found that in the Granite from Dartmoor to Land's End, there are three sets of *master-joints.* First set—horizontal, or nearly so, on the tops of the moors; Second set—nearly vertical, and between Mag. N. and True N.; Third set—not far from Mag. E. and W. These divide the granite into great cuboidal masses. Besides these *master-joints,* there are of course many "cracks, backs, slides, flaws," etc., etc., which are quite irregular and undefinable. The Granite workers split the blocks parallel to the three joints above mentioned, and the forces required to split the blocks in these directions are nearly as the Nos. one, two, and three, respectively. Again, the longer axes of the felspar crystals are on the average nearly parallel to the N. and S. joints, it is therefore quite certain that these joints are (at least in part,) due to crystalline action. In these observations, I have only verified what others have done before; I have also observed in many places, that the *joints of the granite pass, without interruption,* through *the contiguous slates.* Such slates are however crystalline, and altered by the contact of the granite, or probably became solid nearly at the same moment with it. I have however, observed this Summer, traces of parallel systems of Mag. E. and W., and Mag. N. and S. joints in calcareous slates very far from the granite, and many miles beyond its influence. Phillips, in his geology of Yorkshire, has found the *master-joints* in the chain of mountain limestone affecting the above-named

directions, viz:—Mag. N. and S., and Mag. E. and W. The same observations have been made by Mr. Hopkins, in Derbyshire, and extended into the coal field. Now, I am anxious that you, whom I respect as a careful and good observer, should bear these facts in mind, whenever you visit the rocks of your neighbourhood. Note the master-joints carefully, and by comparing different points together, try to reduce the results to system. Try also to put Wright on the same scent. The observations should be carefully made and registered: but they are not very troublesome, and may be made from time to time as occasion offers. Among mechanical rocks, I have also seen many examples of joints in the same direction as the dip, and also at right angles to it, i.e. dip-joints and strike-joints; as I am in the habit of calling them. These, at least, have nothing to do with the points of the compass. I do however think that I was wrong in what I published some time since, when I stated that joints were due to mechanical, and not to chemical forces. I thought then that they were produced mainly by contraction, when the primeval masses passed into a solid state. This theory may explain the origin of some of them; but it does not account for others which I now think the results of crystalline action. Besides the *stripes*, you so well know, parallel to the beds and crossing the cleavage of slates—there are sometimes in Cornwall very fine stripes, resembling scratches along the surface of the Slates, and also a kind of false stripe. The striæ and false stripe, are both parallel to joints in the same or neighbouring rocks of the quarries; I don't remember having seen such appearances in the green slates of Cumberland: but I think there is sometimes a false stripe in the Skiddaw slate. I am not sure I make myself understood; but I shall be glad to hear from you on these subjects, and when I can procure a frank, I shall perhaps trouble you again with some questions. The winter has already set in with much severity, and we have thick snow on the ground accompanied by hard frost.

Believe me, dear Sir,

Very truly yours,

A. SEDGWICK.

From Mr. Otley.

Keswick, December 20th, 1836.

Sir,—

I should not have so long delayed acknowledging the receipt of yours of the 29th October, had I been able to say anything satisfactory in reply. With regard to the joints in the slate rocks, I have found them running in such various directions that I considered them accidental, and the result of contraction; and having imbibed that idea, I have observed nothing to make me relinquish it. For some years I have travelled but little, and had few opportunities of conversation

with any experienced geologists. The only rock that I have encountered since I received your letter is that of Castlehead, near this town. I find the most general bearing of joints in that rock is about 46° W. of true N., and nearly perpendicular; at least in the upper part: but there is a portion of rock appearing on the S.E. side, about three yards thick, which is divided by parallel joints bearing 40° E. of true N., and dipping to the N.W., at an angle with the Horizon of forty degrees. Beneath this the rock appears to regain its former perpendicularity. In a quarry on the E. side, where they are getting stones for a new church, now building at the south end of Keswick, I observed a master-joint bearing about 65° W., and on the S.W. side I observed one in the magnetic meridian: but there are indeed joints in every imaginable direction.

I had a letter from Professor Phillips, in which he asks if I have noticed any general directions to the joints, etc., in the slate; I answered that I had not; and to his question—"is there any 'bate' besides the cleavage?"—I answered that, according to my notion, the Skiddaw Slates have a cleavage without a *bate*: the green slates have a bate synonymous with cleavage; and that the Ingleton slates possess both bate and cleavage in some degrees.

I dare say you are acquainted with that property in the green slates, especially those of Borrowdale, which admits of their being cut, that is, being divided into breadths in a certain direction; of which I cannot discover the relation to either the cleavage or stratification. This, and the bate, I am willing to refer to crystalline action; but that of the joints I cannot comprehend; as they include angles of such various degrees.

I showed your letter to my neighbour Wright, who has of late had better and more frequent opportunities of observing and learning the opinions of others than I have had; but he has not paid attention to this part of the subject.

I have been puzzled a good deal by what you call *a false stripe* in the Skiddaw Slate, as I could not refer it to the stratification, as we are in the habit of doing in the green slate, I suppose one is an effect of lateral pressure, the other of deposition.

In summer I spent a few days upon the coast about Flimby; there are a great variety of granite pebbles along the beach there, and at Allonby; but I was most at a loss to trace the blue stones there in such quantity; I suppose it is the Scotch *Whinstone*, so much spoken of by the late Mr. Mc.Adam in his road-making.

I am quite aware of the trouble you will experience in arranging your multitudinous observations: in my limited ones I find considerable difficulty in finding what I am in search of; and the observations not being all made, with equal accuracy, makes it still more perplexing. I find two observations on Brathay Flag quarry, which is one of our best sections in the upper slate. Taking a mean, what I call the plane of stratification, bears 85° E., dipping S. at an angle of 25°; the *bate* or cleavage bearing 55° E., nearly perpendicular.

I am quite well in health at present, but last winter, I had a complaint begun in my hand, which deranged my whole frame, and summer was considerably advanced before I regained my usual strength. Although, as Dr. Southey says, passing into "the sere and yellow leaf," I am still proud to be acknowledged as one fit to be spoken with on a subject of science; and shall always be glad if I can answer any question you may honour me with.

I am, Sir,

Your obliged and obedient servant,

JONATHAN OTLEY.

From Professor Sedgwick.

Cambridge, February 14th, 1847.

My dear Sir,—

I do not know how many years have passed away since I last saw you; but I continue to remember, with undiminished pleasure, the happy days I spent with you among the Cumbrian mountains in the summers of 1823 and 1824. Then I was a vigorous walker and climber among the mountains. But alas! twenty-two years have taken away from the strength and activity of my limbs, and I, year by year, find myself less equal to those robust tasks I formerly set myself. In short, I have nearly done my field work, and all I hope to do now is, to draw up a systematic account of our older rocks, in two parts. The first part is to include all the slate rocks, and the sporiated unstratified rocks below the old red sandstone. The second part is to include the old red sandstone—the rocks of Devon and Cornwall—the carboniferous series—and the magnesian limestone. There the work is to terminate; for the secondary rocks, including the new red sandstone, do not come within my plan.

My health is not good, for (not to mention the influenza, which I regard as an accident, tho' a bad one, as it has kept me indoors for two months,) each spring and part of each summer, ever since 1830, have I been attacked by rheumatic gout; and while it hangs about me, I am hardly good for anything; but I do trust that within twelve months I may finish the first and hardest part of the work I have in hand. Three plates of fossils, come to me by post, from my artist and naturalist in London, remind me that it is high time to rouse myself, if possible, from this long and weary fit of influenza, and resume my labours.

In describing Cumberland, I shall have to give profiles and sections in various directions; and I should feel greatly indebted to you if you could lend me a helping hand in finishing the profiles; for you know the heights of the hills and irregularities of surface far better than I can do, especially after the lapse of so many years. Any help I receive from you shall be faithfully acknowledged. Should you kindly

consent to this, I would fix upon certain lines of section and send down a rough profile outline to be improved and corrected by yourself. I wish this had been done many years since, but I cannot call back what is past. Your improved map of Skiddaw Forest (made many years since) I have in my drawer, and I hope to make it the foundation of a separate memoir for the Geological Society this spring. I should also be obliged for a list of the mines now working in your country, and of the nature and quantity of their produce. Much has been done in this way since my walks in Cumberland, and no one knows the subject so well as you. I have often visited Coniston, which of late years has become a great mining country; and all the facts I want I could procure from Mr. Taylor. Not that I mean to enter at large on mines or mining,—only to give the leading facts, mineral and statistical, in a note or appendix to some chapter or chapters. Has anything been done of late years in the centre of Skiddaw Forest? When I was there the veins were not worked, except for procuring minerals, of which there were many curious specimens, such as Wolfram, Tungstate of Lime, Apatite, Schorl, &c., &c. But I consider the facts respecting the mineral veins of less importance to my intended work, than the profiles I have mentioned. There is another subject I often thought of writing about while I was rambling during the two last summers with J. Ruthven of Kendal. He told me that my letters, published in Mr. Hudson's Guide to the Lakes, had hurt the sale of your work, and that you rather complained of it. He did not say that you complained of me, and I assure you, you had no reason to do so; for I have no pecuniary interest whatsoever in Mr. Hudson's Guide. I have told my tale fairly in my letters. Before I ever saw your face (which was in the summer of 1823), I had promised Mr. Wordsworth, when he published a new edition of his Essay on the Lake Scenery (I do not remember its title), to give him a sketch of the Geology of the Country. He asked me to do so (I think in 1822 and again in June, 1823), and I said, "I have yet to learn the Geology of your country; but by the time you bring out a new edition, I hope to know enough for the kind of sketch you ask for." Thus I gave my word to him, more than once. My promise was not claimed for twenty years; and it was claimed by Mr. Wordsworth in a letter to me at Cambridge; and when I sent down the letters to Mr. Danby of Kendal, who undertook to see them thro' the press, I did not know what was the exact nature of Mr. Hudson's work. I thought it was to be little more than a reprint of Mr. Wordsworth's former little book, with a few notes and additions. If I have hurt the sale of your work, I am truly sorry for it; for I think it one of the very best guides that ever was written, and I always recommend it. But I have also hurt the sale of Panoramic Views by Mr. Westall, my brother-in-law. He tells me that I have almost destroyed the sale of views of which he before had made a considerable profit. If so, there was no help for it. I was bound by my promise, and must have performed it, tho' I had foreseen the conse-

quences, which assuredly I did not; for I sent down the letters never dreaming about any injury they might do to the sale of any other work, and was very glad when they were once off my hands. I trust you will see by this explanation how entirely free I have been from any unkind feeling towards yourself. Do you wish to publish a geological map of your country, on the scale of your Lake Map? If so, I would most willingly help you to the best of my power; and you might use my name in any way you thought fit. I think such a map, with a short explanatory sheet, might have a sale. Have you a copy of the last edition of my letters (published 1846) with the long list of fossils? If not, I will tell Hudson to forward you one with my compliments. I think it is now high time to set you at liberty. I shall be glad of any geological news. Is Charles Wright flourishing and making discoveries? Remember me to him and any one else who remembers me.

Very truly yours,

A. SEDGWICK.

From Mr. Otley to Professor Sedgwick.

Keswick, February 24th, 1847.

Rev. Sir,—

I was very glad to see your writing after so long absence; at the same time I feel for the infirmities of which you have to complain. I should have had great pleasure in executing what you request, if I had felt able to do it; but if I should undertake what I found myself incapable of completing, it would hurt my feelings too much for me to bear. I am as well as a person can expect to be at the age of eighty-one; but I have left off rambling the mountains for the last ten years. The last time I was on Helvellyn was with Dr. Dalton in 1836, and my last time on Skiddaw, the same year. I was so kindly noticed both by Dr. Dalton and yourself, that to see each of you once a year was one of my principal and greatest enjoyments. If I had been as I was twenty years since, when I made you the map of Skiddaw, I think I could not have managed what you require, without having time to walk along each line of section, or at least within sight of it. I have seen so little of the mountains for the last ten years, except those in my view every day, that my recollection of their features is not so perfect as it once was; and some of your sections will pass through parts with which I have never been much acquainted; besides, I am but a poor draughtsman. Mr. Foster was not satisfied with what I had drawn and engraved myself for the Guide, but he sent an artist to draw them afresh from the same points of view for the last edition.

Mr. Flintoft's model would be of service in drawing these profiles; and perhaps Mr. F. might be the likeliest person to do it. I may observe, there is one thing not quite satisfactory in drawing a section; if the vertical dimensions are on the

the same scale as the horizontal, it looks very poor and flat; and if the vertical line is enlarged, it will appear distorted.

Mr. Flintoft was in London some weeks last summer exhibiting before Parliament a model of a gentleman's estate in Lancashire, to show how it would be affected (injured) by railways passing through it. There is nothing doing in the mining way at present in this parish, except the Black Lead Mine, and I believe they are getting little or nothing. I understand they are driving a level below all the old workings. There is nothing doing in Loweswater, and I think Routen Gill is the only place in Caldbeck Fells. The search for mineral specimens near the Caldew is nearly abandoned; the surface has been so often examined, there is little to be found. Greenside Mine is still, I believe, going on favourably.

When my map first came out in 1818, Mr. Farey was at the Black Lead Mine; he felt great interest in it, and got favorable notices inserted in the Monthly Magazine. When here again, about ten years later, he pressed me very much to colour it as a geological map, and so did others. I tried a few, but could not entirely satisfy myself, and did not find it likely to be profitable. I sold to Dr. Buckland and Mr. Greenough each one, with a sheet taken out of the Guide, at 5s. each. This was the most I recollect making of it.

I am sorry that you should feel it necessary to enter into a particular explanation of the circumstances which led to the appearance of your letters in Mr. Wordsworth's Guide. I am quite sure it was far from your intention to do anything that would tend to my disadvantage. I always felt a pleasure in seeing ever so short a notice in the "Athenæum," of any paper you may have been reading; but I did say to Mr. Ruthven, and perhaps to others, that I had rather have seen your letters in some other work than a Guide to the Lakes; as, if they augmented the sale of Mr. Hudson's work, of course mine would be diminished; at the same time, I am bound to acknowledge my gratitude for the manner in which you have mentioned my name on this as well as on other occasions, and your recommendations have undoubtedly tended to my advantage.

In 1837, I saw you at Kirkby Lonsdale; I was there again in 1842, when Mr. Fisher told me you had written an article on Geology for Mr. Wordsworth to insert in a Guide. I could have liked much to have seen it before mine was printed, but there was no opportunity; however, at Kendal, on my return, Mr. Hudson kindly presented me with a copy of his work. I have not got a copy of your last letters, but have seen it at the bookseller's; you know I am very ignorant on the subject of fossils.

I know something of the history of Wordsworth's Guide, as it was once named, and is now generally called, although Hudson has changed its title. After mine came out, Mr. Nicholson made an overture to me for the future publication, but I told him I could not take it from Mr. Foster, who has assisted me in bringing it

out. Afterwards they made some arrangement with Mr. N. I have a copy labelled, "Wordsworth's Guide through the Lake District. 4s. Fifth edition." And on the title page, published by Hudson and Nicholson, 1835, in 140 pages, including an Itinerary of the Lakes "with permission of the Author." I asked Mr. Nicholson whom they called the author, as a great part of it had been published as an accompaniment to my map of the Lakes ever since 1819.

Speaking of Mr. Westall, I think "Fisher's Views," of which hundreds are annually sold here at 3d. and 2½d. each, do more harm to Mr. Westall's sale than any other thing. I was somewhat displeased with Mr. Flintoft when he imitated for Mr. Hudson my sketches of mountains, to many of which I had furnished him with the names; and perhaps Mr. Hudson may not like that he has done the same for Black's Guide, which is got up in such a way as to be the most formidable rival that has yet come out.

Mr. Brayley was here on account of some property of which he is left trustee; he sent me a syllabus of two lectures he had been delivering on the Geology of the Lake District.

Mr. Cooper still attends, at the season, with a splendid collection of crystallized minerals, and also a great variety of cut and polished articles.

My usual walk is to Barrow Common. I have only been twice to Lowdore in the last year. I have stood this winter, so far, better than I did the last. My hearing is the greatest defect at present.

To a person that could be persuaded to expect fossils in the red rock, on Barrow Common, it would require no great stretch of the imagination to discover the impression of an ammonite twelve inches diameter on the road-side, just within the old gateway; I believe it was not exposed when you were here.

Mr. Foster was at an unwarrantable expense in procuring the woodcuts for my last edition, and if there is a deficiency of sale, the loss will fall more heavily on him than me. I am afraid we cannot yet afford another edition. I have been writing a page on the introduction of railways, which is all that I shall be able to add this year. If I cannot lay claim to superiority, I can to originality. I have laid a foundation on which others have built, and if they rise above me, I must be content to live on the ground floor. I will keep the thing alive as long as I can, though I sell but a few copies. I am happy to say that my comfort, and better or worse living, does not depend now upon the sale of the work.

Draft of a letter from Jonathan Otley to Professor Sedgwick.

The above *draft*, when compared with the actual letter sent to Professor Sedgwick, which Professor Hughes has kindly sent me, shows how carefully written all his letters were; the matter in both is much the same, but the arrangement of paragraphs somewhat different.

From Professor Sedgwick.

Norwich, May 2nd, 1853.

My dear Sir,—

Your kind remembrance has been forwarded to me at Norwich, where I am now residing, and I heartily thank you for it. I cannot forget the happy and laborious days I spent in Cumberland, and the pleasure and instruction I had from your society. Alas! thirty-one years have passed away since I first saw you at Keswick. Every spring I am tormented by a long lingering rheumatic affection, they call suppressed gout. It takes away my sleep, and destroys my spirits. I have it now. Business calls me away for one day to Cambridge, and I stumbled, while packing my bag, on your note, and I resolved to answer it forthwith. Some one told me a few days since, that poor Charles Wright had come to an untimely end. Is it true? Pray send me some Keswick news. And if it would not trouble you too much, I will send you a few questions about the mineral veins, now worked or formerly worked near you. The *fly* is come for me; and the trains wait for no man. So no more at present. I hope to see you in the summer.

Ever truly and gratefully yours,

ADAM SEDGWICK.

From Professor Sedgwick.

Norwich, May 12th, 1853.

My dear Sir,—

Your long and kind letter reached me yesterday morning, and I was shocked at your allusion to poor Bird's suffering and death. From your words I suppose he has met with some horrible death; but I am anxious to hear more on the subject, as no one had mentioned it to me before. He was an old pupil of mine, and tho' eccentric in his habits, he was at the bottom a kind-hearted man, and he has I believe a great regard for me. Pray is his widow living? In regard to your printed paper, I can offer no opinion on the *first part* of it, as I do not know the arrangement of the drifted matter to which you allude. I am a believer in *great currents*, such as you imagine, and they have, I doubt not, been caused by sudden changes of level between sea and land. The second part of your paper is ingenious and good. I hope to see Keswick again this summer, and to have the pleasure of shaking you by the hand. Remember me to Wright, if you see him. He is worth a hundred dead men. With best wishes for the restoration of your strength by the influence of summer temperature,

Believe me, very truly yours,

A. SEDGWICK.

P.S.—I am devoured by rheumatic gout, and feel the infirmities brought by sixty-eight winters that have passed over me.

From Mr. Otley.

Keswick, May 9th, 1853.

Reverend Sir,—

I was afraid that my tedious epistle of February 24th, 1847, would have so far exhausted your patience that I concluded if ever I presumed to write to you again my words should be few; and I was truly glad when I found that my short note had been honoured with so instant and kind a reply. I am sorry that your complaint, which you mentioned in 1847, still troubles you. I shall first acquaint you with my own situation in regard to health, that in any future correspondence you may consider that I am, as to myself, not as the same person you saw me eleven or twelve years ago. I enjoyed good health till February and March, 1852, when I felt myself so well that I walked two or three times a week to my favorite spot at Barrow Side, where I could spend hours in amusing myself, by forming little wells in the springs which issue from the mountain side.

As the weather grew warmer, I was obliged to contract my excursions. In the drought of April I stopped at Friar's Crag to see how the depth of the lake was reduced; and the last time that I reached the lake side was the 4th of September. I then began to feel that the old stone stairs that I had clomb for fifty-five years were too hard for me, and I took a small cottage, about three doors from Charles Wright, where I am now living, having got a niece to keep the house; and I felt so gradually losing strength that since the 12th of December I have scarcely been out of doors till yesterday, which was very warm. I reached as far as the market place—nearly as far as the post-office; and to-day being colder again, I reached about the same distance. On leaving my old apartments I was obliged to submit the greatest part of my Books, Botanical and Geological specimens, and watch-makers' tools to the Auctioneer's hammer; such a variety as never was exposed in Keswick, when 336 lots were disposed of, leaving me, after expenses, about twenty pounds.

You do not mention the slip of paper from the Kendal Mercury enclosed with my note, which I have called a bold conception. I enclosed a copy to Mr. Rooke, from whom I have received a rather lengthy reply; he speaks of valuable truths of which he has availed himself as stepping stones, and of which your "bold conception" is a vast move in advance.

Tuesday Morning, May 10th, gloomy and cold.

Snow on Skiddaw, more on Helvellyn.

JONATHAN OTLEY.

Memoranda enclosed in above draft of letter to Sedgwick:—

February 9th, 1827. I shall adopt your three divisions.
January 16th, 1826.
October 29th, 1836.

July 20th, 1841. Relating to Rooke's Geology.

February 14th, 1847. Wordsworth.—In the two last summers John Ruthven told me. Before I ever saw your face (which was in the summer of 1823), I had promised Mr. Wordsworth. He asked me in 1822, (and again in June 1823). I said I have yet to learn the geology of your country. Three letters were published in Wordsworth's guide in 1842.

February 17th, 1855.

From Mr. Otley to Professor Sedgwick.

January 19th to 23rd, 1854.

Rev. Sir,—

On the completion of my eighty-eighth year I feel in somewhat better health than I was last year at this time. I have out-lived nearly all my acquaintances and correspondents; but I am still able to write a letter, or to take a walk to the water-side on a fine day: these have been rather scarce lately, but to-day is better. Yours of May 12th led me to hope that I should see you at Keswick in the course of summer. I was much pleased with the idea, but as summer advanced, reason told me that I could hardly expect it. There is a paper in the "Lonsdale Magazine," for October 1820, entitled "Remarks on the Succession of Rocks in the District of the Lakes, by J. Otley." On reading it now, I wondered how I came, at that time, to know so much of the subject; and was almost ashamed that, with all my opportunities, in thirty-three years, I have learned so little since. I read your three letters to Mr. Wordsworth with pleasure, agreeing in all they contain, and proud of the way in which my name is introduced. Your fourth letter I did not see, till it and the fifth came together in Mr. Hudson's "Complete Guide." In the fourth I was struck with the word *sheerbate*, a term I had not before observed in print, although I had frequently heard it in conversation among the quarrymen. I should say, it has a cleavage diagonal or oblique to the bed; and from the little I know of the Horton flags, I should be inclined to place them in the same category. I have read such parts of your fourth and fifth letters as relate to the district with which I am acquainted; into Wales I cannot follow you. While I feel flattered by the way in which you continue to place my three divisions of rocks before the public, I cannot but feel sorry, that in your endeavour to assimilate the rocks of the two countries, you should be led to remove the boundary, I had thought fully established, between my second and third divisions; but not doubting your reasons sufficient to satisfy yourself in the conclusion you have arrived at in p. 242, I can have nothing more to say. What I have had printed cannot be altered; there are copies of my Guide still on sale; and I can see no probability of another edition ever being called for. With regard to

fossils, I know so little, that it ill becomes me to speak; but I am not convinced of the propriety of joining the Skiddaw slate, and all up to the Coniston flags, in one group. I should rather have seen the fossils arranged the same as plants, viz. the name of the individual and the place where found.

I have almost lost the companionship of our old friend C. H. Wright. He is living chiefly at Swineside, engaged by a Mr. Emerson in superintending about thirty workmen driving levels into the bowels of the mountain on the north of the river Caldew. The chief product I believe is Wolfram. They have met with a little lead and copper, but little of anything is yet brought to market.

I am very lonely. I have had no conversation with anyone respecting your letters; I could not lay them aside without some observation.

If I have spoken freely, I hope it will be received with the same kindly feeling with which you have always treated me.

From Professor Sedgwick.

Norwich, February 5th, 1854.

My dear Sir,—

So you have completed your 88th year, while I have not yet quite completed my 68th; but spite of a difference of more than twenty years in our ages, you have in some respects the advantage over me. Your health this winter has been far better than mine, and your clear hand-writing beats mine out and out. I gave this Autumn, my thirty-sixth course of geological lectures, and to the largest class I ever had to address. This was flattering to an old man, and perhaps I over-exerted myself: for I broke down before the end of my course, and had such attacks of swimming in the head that I was forced to suspend all lectures for fifteen days. The Term was hardly over when I was attacked by bronchitis, and was never able to leave my room for twenty-nine days; and when I had partially recovered and began to go out, I had another attack of giddiness. So soon as I was able to travel, I was sent by my doctor to my nephew and niece, who are in my Canon's residence near this Cathedral; and I was ordered to live on slops, to walk as much as I could bear, and to abstain, as far as possible, from reading, writing, and thinking. All this kind of abstinence I have practised almost literally; so that after more than three weeks' idleness at this place, I am now nearly off the sick list. An accident to some lithographic plates last summer detained me three or four weeks in Cambridge longer than I intended; so that I had a very few days to spare for my north country visit: and really had not time to visit Keswick and St. Bees' as I had fully intended, and greatly wished: but if I have a few days to spare next summer, I hope that I may still have the pleasure of shaking you by the hand, and of congratulating you on your healthy and vigorous old age. My own Father lived

into his 93rd year, had the use of most of his faculties in great perfection, enjoyed a healthy and happy life to the last day of it; and at last died without pain or struggle as quietly as a child drops asleep in a cradle. He was a good man, and as faithful a believer in God's mercies through Christ as if he had lived among and been taught by the Apostles.

I do make a separate group of the Skiddaw slate: and I should give it a separate colour on a Geological Map. I call it *lower Cumbrian*, or, (taking the Welsh type), lower *Cambrian*. The Green Slate and Porphyry I call middle Cumbrian, and I also give it a separate colour. Certainly, if we went by true primeval character, we should have a new colour and a new group at the Coniston Limestones. But the fossils interfere—for the Coniston fossils are absolutely identical with those of the Welsh calcareous Slates, which alternate with, and descend far down into the beds that are analogous to the green slate and Porphyry. The fossils *below* the hard Coniston grits are of the old Cumbrian type. While the fossils above the grits are of the Silurian type. From the two fossil groups I have about one hundred and seventy species, and the number of species common to the two groups amounts only to about three per cent. of the whole. The arrangement of the fossils which you suggest, is actually adopted in the large systematic description of the old fossils in the Cambridge Museum. The names of the several species are followed immediately by the localities. I will some day draw out my North of England list in that way and send it you. There! I have said very little, yet I have contrived to fill my sheet. My lungs are still very tender, so that I dare not expose them to the cold of the Cathedral: by the end of this week I *do* hope to get back to Cambridge. Believe me, with the heart-felt regard of an old friend.

Very truly yours,

A. SEDGWICK.

From Mr. Otley.

Keswick, February 10th, 1855.

Rev. and dear Sir,—

Another year has passed over since our last correspondence. In your last, dated February 5th, 1854, you indulged a hope that I might see you in the ensuing summer. I am afraid that we have little left here to induce you; I should certainly be very glad to see you; but I cannot say why I should be very sorry on your not coming, as if you were here, I should be sorry that I could not enjoy your company as formerly, when we could walk over the hills together; altho', even in 1823, you were too much for me. When I cannot see you, I am always glad to hear of you or from you. I shall expect to hear *of* you next week by the Kendal papers; and anything *from* yourself at a more convenient time, will satisfy me that I am not forgotten by one who has always treated me with so much kindness and

condescension. Not having been able to read or to think much on Geology since my last, I have little to say upon that subject, but to acknowledge my obligation for the considerate manner in which you have replied to my remarks upon your letters, and for your notices of the Good old man. Having entered upon my ninetieth year, I have the use of my limbs, and a good appetite, but subject to various infirmities; that which most interferes with my rest, is a series of fictitious noises in my ears or head, from which I can learn no hopes of relief; and it may take a long time in wearing me down. We have had severe winter weather lately, and I can get but little out of doors; on a fine day I am able to walk to the water-side.

If I mention your proposal to send me a list of fossils, it is only to say that I cannot wish you to take the trouble, as I shall not be able to take advantage of it.

JONATHAN OTLEY.

From Professor Sedgwick.

Cambridge, February 17th, 1855.

My dear Friend,—

Your kind letter has been on my table since Tuesday last, when it first reached me. Allow me to give you joy on having a head as clear, and a hand as firm, as you had in 1823, when I first had the pleasure of seeing you at Keswick. In what you write, and in the manner in which you write, I see no signs of decrepitude; yet you tell me that you have entered on your ninetieth year, and therefore, you are nearly twenty years older than I am; for, to use a good homely expression of my dear native valley, "I am going in my seventieth year;" and, in a few more weeks, if God spare my life, I shall have completed my journey thro' this seventieth year. Let us then, my kind and valued old friend, be thankful for the mercies we have had, and in that spirit try to use well that remnant of life which our Maker still gives us, in a sure Christian hope that all is not to end here, and that our humble duty will be accepted by Him, not for anything in us, but for the sake of One who has paid our ransom and made us free to count ourselves as God's children. Like yourself, I have found my side deserted by old friends. It must be so to any man who lives to seventy. Of course, you feel this kind of solitude still more than I do. During last year my health was never good; and I have begun this year very badly on the score of health. My lecture which was to have been given on the 12th, was thus put off to the 26th. But the terrible weather has prevented the restoration of my lungs to a healthy state, so that I last night wrote to the Mayor, and told him that I did not look forward, with any hope, to being in a condition to perform my promise with any comfort to myself, or advantage to the Society of Naturalists, by the day I had fixed upon. But, God willing, I hope to come down about the middle of March, and at length to perform my promise, the very thought of which makes me unhappy, now that it is

so long delayed in the performance. When I last wrote to you, I fully intended to visit Keswick during the summer of 1854, and now I hope to visit Keswick before the coming summer is over; but I cannot do so with much confidence, considering my many disappointments arising out of uncertain health.

Instead of going down to the north in the summer vacation, I made a short, and I think my last, trip in Wales, to look at one or two doubtful geological sections;—and as a mark of my kind regards, I will send you "Author's copies" of the two papers I published late in the year in the "Annals of Natural History." I have no news; for I live almost in solitude, not being able to go out among my college friends, or to preside at the table in our great hall. And I live in a great measure upon slops. This is, indeed, necessary, considering the condition of my lungs, and my entire want of exercise. How different from the life we led together in Cumberland during many days of the glorious, bright summer of 1824!

I sleep very badly, and rise early, spite of the weather. I light my own fire, which is laid over-night; and I have a cup of coffee by candle-light. When I visit the north (as I hope in a few weeks) I hope again to write to you.

I am, my dear friend, in heart-felt good-will,

Ever truly yours,

A. SEDGWICK.

Otley's meteorological observations further illustrate his industry and carefulness. One MS. book contains his observations from 1844 to 1855, all carefully written out and tabulated; and I trust Mr. Crosthwaite will incorporate these with his own observations at some future time.

Among miscellaneous papers in MS., are numerous calculations of the heights of mountains, notes on floating islands in various parts of the world, and on the helm winds. All these, where concerned with his own observations, have been worked up into the articles on these subjects in his guide-book.

THE CLOSE.

Even in extreme old age his interest in his beloved mountains never failed him. In the year 1841, he had corresponded with the Astronomer Royal about the cistern on the top of Great Gable, and in the autumn of 1854, several letters passed between the Royal Observatory at Greenwich, and Otley's lodging at Keswick. The last of these on either side I will quote.

From the Astronomer Royal.

Royal Observatory, Greenwich.

1854. October 5th.

Dear Sir,—

Your complaints about the cistern on the Great Gable have not fallen to the ground. Since I last wrote to you, I have consulted with Dr. Lietch, who at my request, was so kind as to undertake the practical management of the matter, and we have fairly shifted the man ten feet to the Magnetic West. I have given notice of this to the Ordnance Survey Office, so that no confusion will be produced in their bearings. As you probably remember very well the former state of the cistern, perhaps you will have the goodness to compare notes with Dr. Lietch, or with Mr. John Jackson, the postmaster at Rosthwaite, who went up with Dr. Lietch and directed the wallers in the work. I should be glad to know that the cistern had not suffered under the operations of the Sappers of the Survey.

I am, dear Sir,

Yours truly,

G. B. AIRY.

From Mr. Otley to the Astronomer Royal.

October 10th, 1854.

Yours of the 5th came duly to hand. Dr. Lietch called on me yesterday to say that they had built a nice man on the Gable, according to your directions. If you had not distinctly mentioned *magnetic* West, I should have thought it would have been *true* west, as I presume the Ordnance Maps are laid down from the true meridian. He says they could not perceive any damage that has been done to it. I should have liked that he could have given some more of his observations long since made. He mentioned a natural crack which would prevent the cistern being filled to the very brim, and he threw out a suggestion that the crack might be filled up to ascertain if it was really a spring. I told him I thought that was decided long since, as from the thousands of copies of my description, that have been put into circulation since 1812, where I have said it is not a stream. If I had been wrong I should have been contradicted before this time. I should have liked to have seen John Jackson on the subject, but he seldom comes to Keswick, and I as seldom reach Rosthwaite. Altho' I shall never see it, I am glad that it has been restored to its original state, so that if it ever was worth looking at as a natural curiosity, it may still continue the same. I have some recollection of a natural crack in the rock, I believe in the angle towards Great End.

Between the years 1848 and 1855, a number of letters passed between Otley and Mr. George Harrison, of Longlands, near Milnthorpe.

In one of these dated September, 1848, Otley says, "I have outlived most of my old correspondents, and feel grateful to any who favour me with a few observations; at the same time I should be sorry if I should become tiresome by my questions." In reply, Mr. Harrison remarks:—"I hold it an honour to be in correspondence with a man who has himself given so much useful and interesting information to the world."

In another letter, dated November 2nd, 1849, Otley writes thus to Mr. Harrison:—"The view you describe is such a one as I never had the pleasure of witnessing; indeed, in my younger and stronger days, I never beheld the extreme distant views, sometimes perhaps because I did not think they might be seen; and at one time, if one spoke of seeing Ireland from Skiddaw, it was only to be laughed at; indeed, in all my views from Skiddaw, I have only been confident of seeing the coast of Ireland twice—October 17th, 1817, 5 p.m., and August 16th, 1829, 6 p.m.; and the mountains of Wales I once saw—October 28th, 1818, 11 a.m.—very plainly from Coniston Fell, and in a short time they faded away, and left nothing to be seen in their place. As auxiliary to the clearness, there is something in the refraction of the atmosphere which at some times causes distances to rise into view. On looking for Criffell from Castlehead, it appears about twenty feet higher at some times than others." In reply to the letter from which I have taken the above quotation, Mr. Harrison writes—

November 30th, 1849.

If you had pleasure in writing your very agreeable letter, I am sure I had in reading it; for I know few treats more charming than that of finding a person of your years enjoying in retrospect the innocent occupations of his past life, and thus, in fact, living twice over, as the Roman poet expresses it. Your description of your mountain ramble was so spirited, that I could almost fancy myself going with you, as you rambled over the lofty range, height after height. . . . (Then in conclusion he says—) I shall have great pleasure in hearing further from you, or I can honestly declare that your cheerful buoyant spirit does good to,

Yours very sincerely,

GEO. HARRISON.

On May 3rd, 1855, the same correspondent writes to Otley:—

Dear Mr. Otley,—

You are quite right in supposing that I was deterred from writing to you by a few words in your letter of the 30th of October last, where you say that you

had "*closed* your accounts with all your correspondents." Had I not misunderstood those words, I should have answered your letter long ago, and thanked you for the information contained in it."

This correspondent must have enlivened some of Otley's solitary hours by his lively and entertaining letters. In one dated July, 1855, he says:—"Your mention of Sedgwick reminds me of some letters by the warm-hearted but very comical clergyman, Sydney Smith, to Sedgwick's geological comrade, Murchison, in which he asks whether in the numerous worlds distributed through the universe, one of them might possibly be inhabited by men of stone, perhaps of Parian marble; and then he adds, 'what a Paradise for Murchison to spend eternity with a grey-wacke woman.' If I stumble on Sedgwick, I must rally him about his having a like reason for having hitherto remained a bachelor."

The following letter to Dr. Henry, before alluded to, shows how his mind was in activity in his ninetieth year.

Keswick, August 5th, 1854.

Dear Sir,—

I duly received your valuable present of the "Life of Dr. Dalton." It must have given you considerable trouble to collect and arrange all the materials. Some parts I knew before, but the chief articles are so far beyond me that I shall not think of reading them: but still I shall prize it highly in remembrance of old association. I think you have done justice without withholding anything through favour. In my narrative, p. 155, l. 8, by a typographical error, *hause* is converted into *house*; it will scarcely be observed by any but myself. This word gave me some trouble in my first publication; I thought that *hawse* related chiefly to shipping, and *hose* to garments, therefore as I could find no other purpose to which the word *hause* was applied, I adopted it. I have since found it wrote *hawse* in the ordnance survey.

My general health is nearly as good as it was two years ago, but my limbs are much weaker, my head not so steady, and my eyes more watery.

I am, &c.,

JON. OTLEY.

John Jackson, of Warrington, a member of the Society of Friends, kept up correspondence with Otley to the year of his death (1856). On December 20th, 1855, he writes:—"Seldom, if ever, have I beheld writing so neat and firm by anyone of thy years." Alluding to the life

of Dr. Dalton, in the same letter, Mr. Jackson says, "I attended his funeral, and was in one of the ninety-five carriages. The procession reached probably three-quarters of a mile." Another letter from the same correspondent, dated Warrington, 28th day, 1st month, 1856, begins thus :—

My venerable Friend,—

Although I am writing out of "my turn," I did not like to delay any longer in letting thee know that the *19th instant* was not forgotten by thy friends here. . . . Although the "drinking of health" is I believe much less common, and our Society almost, if not wholly, omit it, yet thine was drunk, and good wishes *expressed*, and, I doubt not, *felt* on thy behalf.

To this Jonathan replied, even after his attack of paralysis, and his Quaker friend responded on February 29th, 1856, thanking him for his *interesting* letter, and in the course of his note remarking, "I well remember the name of Anthony Loajet, but had no idea that it was intended for thyself, being, I readily perceive (after the hint given me) an anagram on thy name."

In the following August, another attack of paralysis deprived him almost wholly of speech, though he continued conscious to the last.

And now, as Otley's last days approach, there comes a final and touching meeting between the two veteran geologists, the one having spent his life among his mountains, and never appearing among the magnates of science in the outside world, and the other toiling in a busy centre of learning, acknowledged as a leader in his own branch, and revered far and wide. Both simple-hearted men, reverencing nature as an expression of all-power and wisdom, and both going down to the grave with a sure and certain hope.

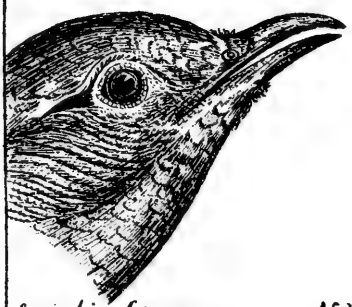
Aged Jonathan lies in his bed helpless and speechless from paralysis, albeit quite sensible, and recognizing the Professor as he stands by his bed-side, silent and deeply moved. Otley's right hand is clasped for some minutes between the hands of Sedgwick, until at last that solemn silence is broken by the Cambridge Professor bursting into tears and crying, as he fell upon his knees, "Jonathan, I'll pray with you." Thus passed their last meeting in this world. On the 7th of December

following, at five o'clock in the afternoon Jonathan Otley died, having thus nearly completed his ninety-first year.

It is not for me, who never had the privilege of seeing the old guide and early geologist, to make comments upon his life and work, other than those already called forth by what has been narrated. But of this we may be sure, that there has been many a man held up to fame for stirring deeds and victories won, who has not half the claim to the admiration of posterity, that quiet, nature-loving, God-serving Jonathan Otley has. May future history rank among its heroes—not the blood-stained conquerors, the amassers of wealth, or the praise-seeking restless spirits—but those who, like Jonathan, did their duty in whatever sphere placed, with child-like simplicity and humble confidence, knowing that true happiness consists in the harmony of the spirit of man with the Eternal Spirit—

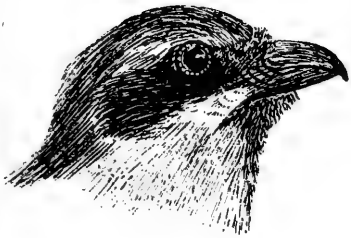
> "And that unless above himself he can
> Erect himself, how poor a thing is man."

BRITISH MUSEUM



Cuculus Canorus. Nat size

Saxicola œnanthe. Nat size



Lanius collurio. Nat size

Caprimulgus Europæus Nat size

Hirundo rustica. Nat size

Scolopax rusticola. ⅓ Nat size

NOTES ON A FEW OF THE MIGRATORY BIRDS OF THE ENGLISH LAKE DISTRICT.

By John Birkett, (Keswick.)

WITH A PLATE.

THE CUCKOO *(Cuculus canorus).*
THE WHEATEAR *(Saxicola ananthe).*
THE BUTCHER-BIRD *(Lanius collurio).*
THE NIGHT-JAR *(Caprimulgus Europæus).*
THE CHIMNEY-SWALLOW *(Hirundo rustica).*
THE WOODCOCK *(Scolopax rusticola).*

THE CUCKOO.

There are few birds which have excited so much interest as the common Cuckoo. Its note in spring, heralding the return of sunny skies and bursting vegetation, carries with it dear associations in every country where it is known. The average date of its arrival in this district is between the 20th and 29th of April, although there are instances when its note has been heard, and the bird seen, earlier; I myself remember once seeing one flying across the side of Latrigg during the second week in April; I was not more than fifty or sixty yards from it, but did not hear its note, nor did I hear the note of any, that spring until nearly a fortnight after. Generally on its arrival its note is heard proclaiming its presence to its mate; this is continued until the season of breeding has passed, the note gradually becoming hoarser and more indistinct as the season advances; and ultimately, before their departure, the birds become entirely mute. The old birds leave us very early; they are among the first of our visitors to depart, none remaining after July;

so that their visit to this district seems confined entirely to the time necessary for seeking suitable places wherein to deposit their eggs, which they do in the nests of other birds. The Cuckoo is the only bird known to manifest this almost unnatural disposition. It has been ascertained without doubt, that the common European Cuckoo, and several foreign species, deposit their eggs in this strange manner, none of the species afterwards attending to the fate of the egg, or to the after rearing of the young.

The Cuckoo does not pair, but is polygamous. The first eggs are seldom laid before the middle of May, or not until the birds have been here three weeks or a month. The egg, which is about equal in size to that of the skylark, is very small, considering the bulk of the bird which lays it. It is white, closely freckled over with grey, or sometimes reddish brown, and generally has a few darker specks at the larger end. Not building a nest for itself, the Cuckoo deposits its eggs singly, and at intervals of a few days, in the nests of a variety of other birds, and leaves them to be hatched and the young reared, by the foster parents. The nests in which the Cuckoo's eggs are most frequently deposited are those of the hedge sparrow, meadow pipit, pied wagtail, and reed warbler; but occasional instances have been known of their being deposited in the nests of about fifty other birds.

I may here mention cases of Cuckoo's eggs and young Cuckoos which have been found in this district. A young Cuckoo was found in a meadow pipit's nest just behind Field Side, a few years ago. I remember seeing a young Cuckoo at the upper end of Thirlmere, which was just so far fledged as to prevent my catching it. I may mention that Mr. Greenip, of Keswick, found a Cuckoo's egg in the nest of a twite, or mountain linnet, in Newlands, on the 24th of May, 1858; also one at the same place, in a meadow pipit's nest, on the 27th of May, 1859. The eggs are extremely rare to meet with, and Mr. Greenip, who has been a collector of birds' eggs all his life, never remembers finding more than these two.

Mr. Dickinson of Corkickle, near Whitehaven, has kindly sent me some information respecting the Cuckoo. He says, "For many years I

have had a weakness for peering into every bird's nest I came across. I admire the artistic beauty and workmanship of the nests, and the pretty eggs therein, and I have had a hope of some day finding a Cuckoo's egg. In only one instance have I so far been successful. The egg was in the nest of a blackcap, in the edge of a gutter on my farm at Ullock, in the parish of Dean. In the summer of 1875, in the parish of Arlecdon, still following up my old habit, I went a little out of my way one day to have another look at the nest of a meadow pipit, which I had observed sometime previously. To my great astonishment, I found there, not a nestful of little pipits, but one young Cuckoo, just shewing a few feathers in his wings and other places; but what a ferocious looking fellow, what a black, diabolical, mischievous eye! He would have pecked me to death if he'd had the power, judging from his earnest endeavours to bite my fingers: he throve apace, and at last left the nest, remaining for a few days perched on an adjoining wall, before finally disappearing. I was careful on the first discovery, to examine the nest and gutter beneath, but found no young pipits or eggs; they might have been washed away by the stream if thrown out of the nest by the Cuckoo."

In the summer of 1867, in the nest of a meadow pipit, near the Nag's Head Inn, Wythburn, a young Cuckoo was observed by my brother; it was the sole occupant of the nest, and was fed by its foster parents until it was fledged; it was then seen for some time flying about the place and perching on the haycocks, until it finally disappeared.

The strange action of the young Cuckoo, in ejecting the other nestlings from the nest, their true home, was long a matter of controversy. It is now, however, needless to bring forward all the evidence from various quarters on this point; suffice it to say that the infant Cuckoo, blind and unfledged, has been seen to get rid of its foster-brothers by insinuating its hinder quarters under the young birds, hoisting them upon its back, and tumbling them over the edge of the nest. Mr. Gould, a great authority, who at first doubted the truth of this strange habit, has now accepted the fact as such.

I will here give the dates of the arrival of the Cuckoo in this district, for a series of years, as noted by Mr. Greenip of Keswick:—

1857	May 3rd	1866	April 26th
1858	April 23rd	1867	April 28th
1859	May 2nd	1868	May 2nd
1860	May 1st	1869	April 15th
1861	April 28th	1870	April 26th
1864	April 25th	1871	April 24th
1865	April 23rd		

THE WHEATEAR.

The name of this bird may have been derived either from the season of its arrival, or from its being captured largely for the table at Wheat-harvest; or again, it may be a corruption of white-ear, a feature very conspicuous in its spring plumage.

The Wheatear is one of our earliest summer visitants, sometimes appearing even when the ground is whitened with the last snow showers of spring. It is plentiful in this district, and is often to be seen on the lower part of the mountain sides. High and Low Rigg, in St. John's Vale, seems to be one of its favourite haunts; and it frequents all commons and waste lands, old quarries, etc. The average period for its arrival here is the last week in March and the first week in April. It spends the breeding season amongst us, and may be seen flitting from stone to stone, from one rising ground to another, along the tops of stone walls, and appearing to fall as it were on the opposite side of the wall, on resuming its flight. It makes its nest in holes under and among rocks and stones, in old walls and quarries, and in the rents or splits of dry peat-mosses. The nest is built according to the form of the hole, and is composed of fine grasses, with a little lining of wool or hair. The eggs are of a pale blue, occasionally spotted at the larger end with a pale rust colour, and are generally five or six in number.

Many instances are on record of Wheatears having come on board vessels several miles from land, at the period of migration; and from the observations of naturalists in various parts of the country, it would appear that these birds travel by night, or at early dawn, as there is not an instance on record in which they have been seen to land upon our shores

in the day-time. The number of Wheatears which used to be taken years ago upon the South Downs, in autumn, is a matter of notoriety.

Like all the chats, the Wheatear keeps much to the ground, seldom perching on trees, although often to be seen on gate-posts and rails, where a broader footing is afforded it. Its song is rather sprightly, and is occasionally uttered on the wing. The contrast between the spring and autumn plumage of this bird is very remarkable. If an old bird be examined in September, it will be found that the white superciliary streak has almost disappeared, the colour of the upper parts has become reddish brown, the throat and breast pale ferruginous, lighter on the flanks and belly, while the primaries and tail at its extremity are much browner. On raising the feathers of the back, it will be found that the base of each feather is grey, and in spring this colour supersedes the brown of winter, which is worn off, and the upper parts assume a beautiful bluish grey, while the under parts become pure white. In this species, therefore, it is evident that the seasonal change of plumage is effected by a change of colour in the same feathers, and not by a moult. The food of the Wheatear during its residence here is composed of insects, small snails, slugs and worms. Insects are sometimes taken on the wing, the bird springing after them from an eminence, or even from the level plain, as well as following them on the ground; after darting upon its prey it often returns, as is the habit of other fly-catching species, to the spot on some raised clod, or grass-grown ant-hill, which served as its look-out and watch-tower.

The geographical range of the Wheatear is very extensive for so small and short-winged a bird. It is found in the Faroe Isles, Iceland, and Greenland; in Lapland, Norway, Sweden, and Denmark; throughout Europe to the Mediterranean; in Egypt, Arabia, Asia Minor, etc.

I append a list of dates of arrival of this bird in the district, as noted by Mr. Greenip:—

1857	April 10th	1866	April 6th
1858	March 30th	1867	March 29th
1859	March 23rd	1868	April 1st
1860	April 6th	1869	April 12th
1861	April 5th	1870	April 8th
1864	March 26th	1871	March 21st
1865	April 10th		

THE RED-BACKED SHRIKE, OR BUTCHER BIRD.

Quite unlike any other of our summer migrants in appearance, the Red-backed Shrike, or Butcher Bird, as it is more frequently called, also differs from them all in habits, and from the majority in having no song to recommend it to notice. It is a curious bird in its way, shy and retired in its disposition, and prefers tall tangled hedgerows, or the thick foliage of the lower branches of the oak, where it can sit unobserved, and dart out upon its unsuspecting prey. It is a very hawk by nature, capturing and killing mice, small birds, and moths and beetles of every size and description. These when caught, are firmly impaled upon the long and strong points of the white-thorn, for future consumption; and the odds and ends which may be found thus hung up, as it were, in the Butcher Bird's larder, are worth notice. On one thorn, perchance, a blue tit-mouse with its head off; on another a small meadow mouse, or perhaps a harvest mouse; on a third, a great dor-beetle, or a cockchafer, not yet dead, but buzzing round and round upon the sharp thorn, and trying in vain to effect its escape; while above, below, and on all sides may be seen the wingless bodies of large moths, the fluttering forms of dragon-flies, or the remains of beetles. From this singular habit, the bird has earned the name of Butcher Bird, not only in England, but in other countries. In France it is termed the Flayer; in Germany it is known as the Strangler, or Garrotter.

The Red-backed Shrike arrives here somewhat later than most of the summer migrants, and is seldom seen before the first week in May. They are generally found in pairs until after the young are hatched and ready to fly, when the families keep together in little parties until at the end of August or beginning of September they leave the country, and cross the Mediterranean into Africa. They travel down the east coast through Egypt, Nubia, and Abyssinia, to Natal; and on the west coast they have been met with in Great Namaqua Land, Damara Land, and the Okavango region, where, according to Andresson, breeding goes on in winter quarters.

The distribution of this bird in the British Islands is very partial,

for it is unknown in Ireland, of rare occurrence in Scotland, and in England is found chiefly in the midland and southern counties, though we have a few pairs every season in this district. The pair belonging to our museum was procured in the valley between Derwentwater and Bassenthwaite Lake, in the summer of 1875; and, curiously enough, two other Butcher Birds took possession of the same thorn bush the next season; perhaps it was that the shambles were ready fitted up, and the place being unoccupied, they were tempted to secure it.

A young Butcher Bird was observed last summer on the line of the Cockermouth, Keswick, and Penrith railway, near The How, with one foot amputated, supposed to have been done by a passing train; the bird seemed not to have been injured in any other part. Perhaps this was one of the progeny of a pair of Butcher Birds which have been known to nest in a thorn bush by the river side, near to Braithwaite bridge, for several years. I have also been informed by a very trustworthy person, that about thirty years ago, two pair of Butcher Birds regularly nested in Langton Moss for many years.

The hen bird is much the plainer in appearance, being of a dull and somewhat mottled brown above, and buffy white beneath, with crescentic brown markings on the breast and flanks. The bill in both is short and thick; the upper mandible is hooked at the point, and prominently notched or toothed, as in a hawk. The feet are strong, with sharp and curved claws, and well adapted for seizing and holding a struggling prey. Both birds assist in the construction of the nest, which is a substantial, well built structure of twigs, dry grass, and moss, lined with fibrous roots and horse-hair, and is usually placed at some height from the ground in the middle of a white-thorn bush, or thick hedgerow. The eggs, five and sometimes six in number, vary a good deal in colour, being yellowish or grayish white, with lilac or pale brown markings disposed in a zone at the larger end; or pale salmon colour, with dull red markings distributed in the same way.

The following are some dates of arrival in this district since 1857:—

1857	May 13th	1865	April 27th
1858	May 12th	1867	May 6th
1859	May 12th	1868	May 18th
1860	May 12th	1871	May 9th
1861	May 10th		

THE NIGHTJAR, OR HAWK.

In order of date, the Nightjar is one of the latest of the summer birds to arrive, being seldom seen before the beginning of May, although, as in the case of other species, one now and then hears of an exceptionally early arrival. Between the months of April and October, our Nightjar is generally dispersed throughout the British Islands; by the end of September, or the first week in October, these birds have returned to their winter quarters in North Africa. Colonel Irby, in his recently-published volume on the "Ornithology of the Straits of Gibraltar," states, on the authority of M. Favier, that Nightjars cross the Straits, from Tangiers to Gibraltar, in May and June, and return the same way, between September and November; they have been seen on the passage. Dr. Drummond informed the late Mr. Thompson of Belfast, that when H.M.S. "San Juan," of which he was surgeon, was anchored near Gibraltar, in the spring of the year, a few Nightjars flew on board. During the passage of H.M.S. "Beacon," from Malta to the Morea, in the month of April, some of these birds appeared on the 27th, and alighted on the rigging. The vessel was then about fifty miles from Zante (the nearest land), and sixty, west of the Morea. They came singly, with one exception, when two appeared in company.

The Nightjar, although tolerably dispersed throughout North Africa during certain months of the year, does not, apparently, travel so far down the east or west coasts as many of our summer migrants do. In Egypt and Nubia, according to Captain Shelley, it is only met with as a bird of passage, but how much further south it goes he does not say. Mr. Blandford did not meet with it in Abyssinia, where its place seems to be taken by two or three allied species. The same remark applies as we proceed eastward. In Syria and Palestine, Canon Tristram did not observe the European Nightjar, but found a smaller and lighter coloured species, on which he has bestowed the name *Caprimulgus tamaricis*. Stragglers have been observed in summer and autumn for several years in Shetland. The late Dr. Saxby saw it at Balta Sound, about the end of July, skimming over the fields, and now and then alighting on the

dykes; but he regarded its appearance in Shetland as merely accidental. In Ireland this bird is considered to be a regular summer visitant to favourite localities in all quarters of the island, but of rare occurrence elsewhere. There are a few to be found in this district every season.

I once had the good fortune to find a Nightjar's nest myself, on a place called Moss Hills, at the south-east end of Shoulthwaite Moss, and about a quarter of a mile from the high road to Windermere. The nest, of a very shallow basin shape, was close to, and partially under, a heather bush, apparently for protection from the south-west storms. The ground in the immediate vicinity of the nest was wild, heathery, and broken, and partially covered over with ferns. In the nest were two young ones, about half fledged. Their appearance was singularly ugly, on account of their enormous mouths and large prominent eyes, which gave them an expression almost repulsive. I paid a good many visits to the two young Nightjars, but only on one occasion did I see the old bird, which flew from the nest, or near it. I could not be certain, but I fancy it had been feeding the young. Any fine calm summer evening, especially a moonlight one, if walking along the main road at the foot of the moss, one is almost certain to hear the whirring note of a Nightjar. I have on different occasions, on a moonlight night, about half-past nine o'clock, heard the whirring note, as if it were close over my head, and the next few seconds it sounded half a mile distant; but this was owing to the fact of the bird being a sort of ventriloquist, and the sound seems to come from different places, because the bird turns its head from side to side, and both up and down, and scatters, as it were, the notes on every side, so that one is quite puzzled sometimes to know where the bird is. I have stood and listened several times, but have never been fortunate enough to see one of these birds at night.

Notwithstanding what has been said to the contrary, the Nightjar, Night-hawk, Fern Owl, or Goatsucker, as it is variously called in different parts of the country, is one of the most inoffensive birds imaginable. By farmers it is accused of robbing cows and goats of their milk, and by keepers it is remorselessly shot as "vermin"; but by both classes its character is much maligned. In its feeding it is purely insectivorous, and

it is as incapable of sucking milk as it is of carrying off and preying upon young game birds. The mistake in the former case must have arisen in this way: The habits of the bird are crepuscular, and it is seldom seen in broad daylight, unless disturbed; but as soon as twilight comes on, and moths and dor-beetles begin to be upon the wing, it comes forth from its noonday retreat, and is exceedingly busy and active in the pursuit of these and other insects. Montague says he has observed as many as eight or ten on the wing together in the dusk of the evening, skimming over the surface of the ground in all directions like swallows in pursuit of insects. Cattle, as they graze in the evening, disturb numerous moths and flies, and the Nightjar, unalarmed by the animals, to whose presence it becomes accustomed, dashes boldly down to seize a moth which is hovering round their feet, or a fly which has settled upon the udder. Being detected in this act in the twilight by unobservant persons, the story has gone forth that the Goatsucker steals the milk. From the keeper's point of view, it is a Night-hawk, in the worst sense of the word; a hawk that under cover of the night flits noiselessly but rapidly by, and carries off the unsuspecting chick. But here again the observer has been misled by appearances, associating the pointed wings and long tail with the idea of a hawk, entirely overlooking the small slender claws and mandibles, which are quite unequal to the task of holding and cutting up live and resisting feathered prey, and also entirely overlooking the fact, that at the time the Nightjar is abroad, the young pheasants and partridges are safely brooded under their mothers' wings. Attentive observation of its habits, and examination of numerous specimens after death, have revealed the real nature of its food, which consists of moths, especially *Hepilus humuli* (which from its white colour is readily seen by the bird), fernchafers, and dor-beetles. Mr. Robert Gray of Glasgow, has seen it in grass-fields, cleverly picking ghost moths off the stems, from the points of which these sluggish insects were temptingly hanging. "But as a rule," he adds, "the Nightjar captures its prey while in flight." Macgillivray says: "The food which I have found in its stomach was composed of the remains of coleopterous insects of many species, some of them very large, and occasionally larvæ; I

have seen the inner surface slightly bristled with the hairs of caterpillars, as in the cuckoo." He adds, "As no fragments of the hard parts of these insects ever occur in the intestine, it follows that the refuse is ejected by the mouth." From its habit of capturing dor-beetles, the bird in some parts of the country is known as the Dor-hawk. Wordsworth has referred to it by this name in the lines—

"The busy dor-hawk chases the white moth with burring note."

Elsewhere it is called the Eve-jar, and Churn-owl; the latter name is bestowed by Gilbert White, in his "Naturalist's Summer Evening Walk"—

"While o'er the cliff the awaken'd Churn-owl hung,
Through the still gloom, protracts his chattering song."

In his 37th Letter to Pennant, the same author refers to it as "the Caprimulgus, or Fern Owl," and gives an agreeable account of its movements as observed by himself. Amongst other things he says: "But the circumstance that pleased me most was, that I saw it distinctly more than once put out its short leg while on the wing, and by a bend of the head deliver somewhat into its mouth. If it takes any part of its prey with its foot, as I have now the greatest reason to suppose it does these chafers, I no longer wonder at the use of its middle toe, which is curiously furnished with a serrated claw." Yarrel has figured the foot, in a vignette to his work on "British Birds," in order to show this peculiarity of structure, the use of which has puzzled so many.

The correctness of the view expressed by Gilbert White, and confirmed by other authors, has been disputed, on the ground that many other birds, as herons, gannets, and I may add coursers, have a pectinate claw upon the middle toe, and yet do not take insects upon the wing, or even seize their prey with their feet.

It has been ingeniously suggested that perhaps the serrated claw may be used for brushing away the broken wings and other fragments of struggling insects which doubtless adhere occasionally to the basirostral bristles with which the mouth of the bird is furnished. This is very possible, at the same time it may be observed that hawks, parrots, and

other birds habitually cleanse the bill and sides of the gape with their feet, and yet have no pectination of the middle claw.

A theory advanced by Mr. Sterland, and endorsed by Mr. Robert Gray, is that since the Nightjar sits lengthwise, and not crosswise, upon a bough, the serrated claw gives a secure foothold, which in so unusual a position could not be obtained by grasping. But to this theory the objection above made also applies, namely, that many birds, such as coursers and thick-knees, have serrated middle claws, and yet are never seen to perch. Some naturalists, and amongst others Bishop Stanley, have surmised that, by means of its peculiarly-formed toes, the Nightjar is enabled to carry off its eggs, if disturbed, and place them in a more secure spot; but should any such necessity arise, one would think that its large and capacious mouth, as in the case of the cuckoo, would form the best and safest means of conveyance. In the young Nightjar, the peculiarity in question is not at first observable; and Macgillivray remarked that in a fully fledged young bird, shot early in September, the middle claw had only half the number of serrations which are usually discernible in the adult. He says: "All birds whose middle claw is serrated, have that claw elongated, and furnished with a very thin edge. It therefore appears that the serration is produced by the splitting of the edge of the claw after the bird has used it, but whether in consequence of pressure caused by standing or grasping, can only be conjectured." I have detected some confirmation of this in the case of the common thick-knee, or stone curlew *(Œdicnemus crepitans)*, in some specimens of which I have remarked a very distinct serration of the middle claw, in others only the barest indication of it (the edge of the claw being very thin and elongated), in others again no trace of it.

The objections, however, which have been taken to the suggested use of the pectinated claw in the Nightjar, do not invalidate the statements which have been made by Gilbert White, and other observers of the bird's movements and habits; for the homologous structures which are found to exist in certain species in no way related to each other, may well be designed for very different functions. I do not find in the works of either Macgillivray or Yarrell, any mention made of the peculiar

viscous saliva which is secreted by this bird, and which reminds one of what is observable in the case of the wryneck, and the different species of woodpecker. It no doubt answers the same purpose, namely, to secure more easily the struggling insects upon which its existence depends.

THE SWALLOW.

The chimney Swallow is one of the earliest arrivals, coming from Africa over the English Channel about the middle of April. Every one seems glad when the first Swallow flits across the village green, but we sober English have never kept a "Swallow holiday" on the 15th of April, which is, in some parts of Europe, called "Swallow day." In ancient Greece the children might well clap their tiny hands when the birds of spring appeared, a holiday being then given to little boys and girls. They danced in the market-places, wore garlands of early flowers, and shouted in the luxury of childish joy. That was a capital plan for making children love the birds. These birds are called chimney Swallows from their tendency to build in hollow places, such as old mine-shafts, disused wells, chimneys, insides of barns, cow-houses and sheds. They generally build their nest against the sides of beams, rafters, or any wood-work of the roof; it is composed of clay, and strengthened with straws or slender roots, lined with feathers, and open at the top. Two or three pairs often frequent the same outhouse, and are known to have returned from year to year to the same nest. The chimney Swallow is easily known by its deeply forked tail, the ruddy hue on its throat, and its lightish tinted breast. The rapid movements of the bird—its sudden darts and turns, now up, now down, over the observer's head, then skimming the ground in long arrow-like flights—present a specimen of a living machine in beautiful and perfect action. But notwithstanding this power of flight, the birds are sometimes completely exhausted by their journeys across the sea. They can battle for a long time with the mere force of a tempest, but when the blast is both cold and strong, the winged voyagers are almost paralysed. A whole army of Swallows will

then crowd the rigging of some lonely ship, clinging for hours to ropes and spars, until recovered strength again enables them to obey the "forward" impulse. No wonder if these beings of summer climes sometimes marvel at the rough treatment received in our ruder latitudes; a cutting "north-easter" is no smiling reception for a creature which has been basking for months in the sun of Egypt. On one bitter spring day, a gentleman* picked up in the course of his morning's walk ninety-two chimney Swallows, not dead, but benumbed by the cold. Being placed in a warm hamper, they all recovered, and flew off the next day. On another occasion numbers were found on the window-sills of a country house, heaped on each other five or six deep. Instinct had clearly led them to seek aid from man. Some may naturally ask—Why do Swallows so eagerly rush from the warm regions of the south to battle with the storms of the north? We cannot answer the question, guessing on such subjects is trifling; that there is some wise purpose in the habit we may be sure, or it would not exist. Another remarkable characteristic of chimney Swallows is their courage—look at these birds fighting with a hawk, and then say whether they are cowards. Of course they suffer for their daring? Not in the least—the hawk gets the worst of it, and retreats in a fury from the inglorious contest. What can the hawk do? He is a brave fellow, but the Swallows are too quick for him, darting down on his back, and up again with a speed which baffles the clutch of his talons. He resembles a heavy seventy-four man-of-war surrounded by a fleet of steam gun-boats: strength is beaten by speed.

The chimney Swallow does not come to the British Isles for a holiday, that is certain, but for downright hard work. The building of a house, and the bringing up of two families in one short season, are enough to tax the energies of the most enterprising bird. The parents are so hard pushed for time, that the first family often receives warning to quit before its education is quite complete. But the little things soon manage to provide their own food without the aid of the mother bird. The second family sometimes fares the worst, being forced to join in the great autumnal migration as soon as they are able to fly. The

* Dr. Hunt, of Addlethorpe.

assembling of these birds is a well-known sight—how closely they crowd on the house-tops, trees, and railway wires, sometimes roosting together amongst the long reeds fringing some lake or stream. I once saw some hundreds among the tall reeds, near to Lodore beck foot. Three of us were in a boat "looking for Snipe," on a very fine clear evening, early in the month of October, when all at once our attention was aroused by something like a strong breeze in front of us ; daylight had partly gone, so we could not see very distinctly ; our boat was sailing along partially amongst the reeds, which were so numerous we could not see far through them, and in a few minutes another strong breeze seemed to be blowing. We were all quite puzzled, and could not account for it, when all at once, on rounding a corner of the reeds, we got close to the Swallows, which were just rising from amongst the reeds and flapping their wings amongst the reed stems. There seemed to be three or four Swallows on each stem, and the reeds moving and rattling against each other, produced the sound we previously had heard.

The attachment of Swallows to the neighbourhood of water at roosting-time—which formerly led to the supposition that they actually retired under water for the winter—may be easily accounted for by the circumstance that the willow branches and reeds not only afford them most convenient perches, but enable the birds to crowd closely together, and so secure greater warmth to individuals than they could possibly enjoy if each roosted upon a separate twig in trees or shrubs of different growths.

The greater number depart in a body; and the retreat which was one night enlivened by their evolutions and sprightly twitter, is the next solitary, or rendered to all appearance more deserted by the presence of the few who have been unable to accompany the main body. I may here mention one or two instances in which Swallows have been seen long after the usual time of migration. Mr. Dickinson of Corkickle informed me, that "in 1875 in Martinmas week, whilst in the hayloft getting hay for my cattle, I was surprised to see a Swallow flying about in a rather slow, uncertain way, yet still quickly enough to keep out of harm. I can only account for its presence then at that late period, by

assuming that it was the solitary progeny of a pair of birds which regularly bred in the byre underneath, and usually had three broods in the season. In their last attempt they only succeeded in hatching one, which I observed in the nest, and remarked at the time how late it was. The old birds were so tame that they would permit my little daughter to lift them off the nest and replace them without alarm."

The food of the Swallow consists entirely of insects, and it is in pursuit of these that it is seen soaring far above, in the settled days of summer; and, again, suiting itself to the changes in the weather, skimming close above the surface of the lake, or river, or meadow, along the side of a cliff, a hedge, a paling, or a sheltered avenue of trees. When feeding, it flies with the mouth more or less open; and the capture of an insect is indicated by an audible snap of the bill: it drinks and laves itself while on the wing. Do the Swallows render any service to mankind? Yes; they keep the insect myriads within safe limits. If one of these birds should eat but a hundred insects a day, the number consumed in a summer by the whole swallow family might puzzle a calculating machine to enumerate. Many a farmer can ruefully remember the ravages which "the fly" has often made among his turnips or in his hop-grounds. He may well look upon the Swallows as most useful, though unpaid, labourers.

I will now give the dates of the Swallow's arrival in different years, as noticed by Mr. Greenip:—

1857	April 22nd	1866	April 22nd
1858	April 19th	1867	April 20th
1859	April 26th	1868	April 15th
1860	May 2nd	1869	April 11th
1861	April 30th	1870	April 9th
1864	April 21st	1871	April 16th
1865	April 16th		

Let us then, with one consent, welcome in hamlet, village, and town, these confiding summer visitors: wishing them much happiness while here, and giving them a regretful "good-bye" at their departure.

THE WOODCOCK.

The Woodcock has long been in high favor for the table, and has always been much sought after by sportsman. There are now many instances on record of the Woodcock breeding in various parts of Great Britain. Mr. Mawson, of Thornthwaite, informs me that in 1862 he found a Woodcock's nest, in Sir John Woodford's woods, when out in search of insects, on the 24th of June. It contained four eggs; the old bird was rising from the nest at the time. He continued to visit it daily up to the time of hatching, which was on the 7th of July. The old bird allowed him to go within a couple of yards of the nest without being in the least annoyed. The nest was merely a slight hollow in the ground, with a few dry leaves round the sides; the old bird, when sitting, always rested the point of its beak upon the ground, with its dumpy tail almost erect, giving it a curious appearance. The nest was upon a dry bank facing the north, which I believe is nearly always the case with the Woodcock, the bird preferring the shady to the sunny side of a bank. The eggs are very similar to those of the corncrake, being rather larger, but in colour much the same. After hatching, the young birds left the nest almost immediately. In 1872, in the month of May, a brood of four young Woodcocks was seen in the Ladstock wood, not far from the head of Bassenthwaite lake. A setter dog found them, along with the old birds, and made a steady point, when one of the parents rose and flew some distance, then three of the young ones rose, being only able to fly a very short distance at once; after that the other old Woodcock followed, and carried the fourth young bird in its feet a distance of about ten yards down the hill; and on being disturbed a second time, the old bird took up the young one, (which perhaps was not able to fly, or it might be a little weaker than any of the other three,) and flew for a distance of about forty or fifty yards.

In 1875, three young Woodcocks were observed in Ullock Moss, near to Derwent Bank, in the month of April; when discovered, the old bird was in the act of flying about with her wings trailing on the long

grass as if lame. A dog being there at the time, it unfortunately caught hold of one of the young birds and killed it.

In 1876, in the month of July, three young Woodcocks were seen along with the old one, about a couple of hundred yards above Woodland cottage. These were all strong, and could fly pretty well, so it seems probable that a few pair breed every year in this district. Yet it still must be considered as one of our winter migrating birds; the great mass visiting us in the commencement and towards the end of October, and leaving us again in February; and those that breed here are only a few stragglers.

The Woodcocks, when first arriving in this country, may be found in whin cover on the coast, or at a great distance from wood, often on the moors, amidst long heather. They are extremely shy. Sometimes if fatigued with their flight, they can scarcely be got to rise, and frequently, when fallen in with in such a state, are killed in numbers. They soon, however, leave these districts, and do it altogether, scarcely a bird being found in the morning where the day before they had been abundant. Their most favourite haunts, when settled, as it were, for winter, are woods of some extent, where there is cover that can be run through beneath, and where shelter is afforded. Young larch plantations, especially those shaded from the sun, are favourite haunts, as they generally prefer the north side of a hill, and are always found to be more numerous in those larch plantations where there are a few spruce, thorn, and holly trees, whose branches afford shelter, and underneath which there is generally a nice, smooth piece of ground, well protected both from sunshine and storm. They seldom move much in the day-time, unless disturbed, resting by day, and only feeding at times, or turning over the dried leaves. At twilight they regain activity, resorting to the open glades, marshy bottoms, or sheltered outskirts, and then for a time feed in earnest. Their food seems to be aquatic insects or larvæ, which they procure by thrusting their bills into the soft mud, "or boring," as in sporting language it is termed. In this process a quantity of sand is also taken, for the stomach is always filled with it, in addition to any remains of insects that can be seen. In the woods, they also seem to turn over the dead

leaves in search of what may be beneath; and in hard frost, this bird, owing to these peculiarities, is one that suffers most severely. The number of Woodcocks which visit us, varies much from year to year, and without apparent cause. Whatever it may be, it should be sought for in their summer land, not in that which receives them in winter. The migration of the Woodcock is nocturnal, and birds are occasionally taken, after having dashed themselves against lighthouses, attracted by the light. The flight of the Woodcock has been estimated to be at the rate of one hundred amd fifty miles an hour. Its geographical distribution is extensive—besides being generally met with in Great Britain and Ireland, wherever suitable localities occur, its range extends occasionally to Orkney and Shetland, but from the want of shelter, it continues there for no time, as we have seen with various species which range far to the north in the British Islands. Still, abroad, the same degrees do not restrict them; thus, we have the Woodcock extending even beyond the Arctic Circle, and breeding in Siberia, Austria, and Silesia. In an opposite direction, they reach the Italian States, Smyrna, and some parts of the African coast. They are seen at Madeira; and Mr. Yarrell states that the "Zoological Society have received notices of our Woodcock having been obtained at Cashmere," and Dodah near Cashmere, is given by another authority. Specimens have also been brought from India and Japan. The Woodcock is the largest known species of the genus, weighing on an average from nine to eleven ounces. The colours vary in intensity in different birds.

In drawing these remarks to a close, I would beg all who are interested in the subject to observe, on all possible occasions, the habits of our migratory and other birds. Much yet remains to be known, and every observer may extend our knowledge in some direction. On a future occasion I hope to be able to put together my scattered notes upon other species of birds of our district, and shall at all times be glad to receive information collected directly from nature.

COLERIDGE.

A Lecture delivered at Keswick before the Literary and Scientific Society, February 5th, 1877.

By the Rev. J. D. Harington, M.A.

In the early years of this century, for eighteen years—from 1816 till his death in 1834—there lived in a surgeon's house on Highgate Hill, the remarkable man, of whom I have ventured to speak to you this evening. I say ventured; for, in truth, to unravel the mysteries and perplexities, in which Coleridge's life and work were wrapped up, is not quite the simple thing it seemed at first to be. Of disciples he had no lack—sometimes he would receive only one at a time: he would walk with him in the garden, or he would invite him to sit in his own room, conversing volubly all the while, glad to get a patient listener, whether converted to his way of thinking or not. At other times, chiefly, as we read, on Thursday evenings, he would be the centre of a group, to whom he talked, impatient of interruption, liking to have all the conversation on his own side, so that his hearers came to call it "monologue." I cannot refrain from quoting some short extracts, from descriptions of these scenes, which are on record: some not altogether laudatory—rather the opposite—and yet always acknowledging the peculiar power of the man; not, as it seems to me, ill-natured, even in depreciation. "I may say of him," says Hazlitt, "that he is the only person I ever knew, who answered to the idea of a 'man of genius.' He talked on for ever, and you wished him to talk on for ever. His thoughts did not seem to come with labour or effort, but as if borne on the gusts of genius, and as if the wings of his imagination lifted him from off his feet. His voice rolled on the

ear like the pealing organ; and its sound alone was the music of thought. His mind was clothed with wings; and, raised on them, he lifted philosophy to heaven. In his descriptions you then saw the progress of human happiness and liberty in bright and never-ending succession, like the steps of Jacob's ladder, with airy shapes ascending and descending, and with the voice of God at the top." More graphically, in his peculiar incisive way, Carlyle gives us his own reminiscences too. After describing Coleridge's private room, and the view from it, he adds, "No where could you see a grander prospect on a bright summer's day. Here for hours would Coleridge talk, concerning all conceivable or inconceivable things; and liked nothing better than to have an intelligent, or, failing that, even a silent and patient human listener. He distinguished himself to all that ever heard him, as at least the most surprising talker extant in this world;" and elsewhere he adds with some irony, what Hazlitt spoke of him—"Excellent talker, very—if you let him start from no premises, and come to no conclusion."

The person of this surprising talker is drawn with uniformity enough to assure us of the truth of the description. Forgive me for reminding you of Wordsworth's oft-quoted account of him, as of "a noticeable man with large grey eyes." A letter of his own comments on a portrait of himself, recently painted, in these words: "The exceeding weakness, strengthlessness, in my face was even painful to me." Carlyle says of it: "The good man, he was now getting old, and gave you the idea of a life that had been full of suffering: a life heavy-laden half-vanquished; still swimming painfully in seas of manifold physical and other bewilderments. Brow and head were round, and of massive weight. The eyes, of a light hazel," (his gifted daughter describes those of her brother, as being like her father's—"the colour of London smoke,") "were as full of sorrow as of inspiration; confused pain looked mildly from them, as in a kind of mild astonishment; a heavy-laden, high-aspiring, and surely much-suffering man. His voice, naturally soft and good, had contracted itself into a plaintive sing-song; he spoke as if preaching—you would have said, preaching earnestly and yet hopelessly, the weightiest things."

With many weaknesses and defects, as you will gather even from

these quotations, Coleridge was, however, a great man. He has left his mark upon much of the thought of our times; the years that have followed upon his death have been the most remarkable and pregnant years of English History; and in much of what is characteristic of them, there is a touch of the influence of Coleridge. He was a many-sided man; desultory enough, but anxious to give to his time what he felt was best in all branches of thought. He had but little activity, and no energy; and yet he ventured to be at once poet, philosopher, politician, and theologian. And his broken utterances on all these subjects have coloured much of what we accept about them.

Subject to all kinds of obloquy and abuse during his life-time, since his death England has perceived that she had a great man as her son, and did not value him. The "teachers of men" listened to him, and spoke out, and all were then aware that a prophet had appeared and had passed away: not thought much of at the time, as is the case with most other prophets. Except perhaps his critical writings, none of his prose works obtained general acceptance during his life-time. Coleridge spoke only to the faithful few; only to his disciples; and his disciples have influenced their generation. The little leaven has gone far to leaven the whole lump.

To give any adequate notion of the life-work of this man, within the limits of a lecture, is no easy task. Almost all that Coleridge said requires "filtering" through the minds of plainer-speaking men, and "coming out" from their tongues or their pens, to be intelligible to the great mass of English people. This particular point is alluded to in the second stanza of the dedication to "Don Juan," where Lord Byron says:—

> "Coleridge, too, has lately taken wing,
> But like a hawk encumbered with his hood,—
> Explaining metaphysics to the nation,
> I wish he would explain his 'Explanation.'"
>
> *Vide (Biographia Lit.)*

He was one who had great thoughts: but the thoughts were "veiled." There was a haze surrounding them, a haze of words borrowed from German and other philosophies, which English people have never much

cared to penetrate. They believe him to have been great, because other great and dependable men have said so; they have never accepted the fact, or rather, gathered it, from their own apprehension of his merits. I shall try to put in plain words, some of his thoughts on different subjects, that so you may apprehend his greatness, and see that there is a reason for his being said to be so. Perhaps the best way to this end, will be to divide his life into different sections, according to the subjects which, roughly-speaking, occupied it at different times. I will say something of him as Poet first; then as Philosopher; then (though I would not touch this subject, but that a lecture on Coleridge can never ignore it,) of his influence on Theology and Religious Thought. In doing this, I must intersperse my account of what he was as Poet, Philosopher, and Theologian, with a sketch of his life; though it is by no means always easy to trace where Coleridge lived at particular times, and how he moved from place to place, as his restless disposition prompted.

Let us first glance at his career till he came to Keswick in 1800. He lived here three or four years. It is this which gives us here a very special interest in Coleridge. In this place, rich in reminiscences of Poets, he was one of the company of Lake Poets; though he was much besides, both in this and in other places.

Samuel Taylor Coleridge was born at Ottery St. Mary, in Devonshire, in the year 1772. He was the youngest son of the vicar of that place. In 1782, when ten years old, he was sent to Christ's Hospital. This famous school, which has its branch at Hertford, and its centre in Newgate Street; the quaint and antique dress of its scholars, which gives them the name of "Blue Coat Boys," you must all be familiar with. Here the young Coleridge stayed nine years, and then went to Jesus College, Cambridge, in 1791. At Christ's Hospital, he was a contemporary of Charles Lamb, who in after years contributed to literature the charming "Essays of Elia." "At school," he says, "I enjoyed the inestimable advantage of a very sensible, though at the same time very severe master. His name was Mr. Bowyer. 'In the truly great poets,' this master would say, 'there is a reason assignable, not only for every word, but for the position of every word.' At the same time we were studying the Greek

Tragic Poets, he made us read Shakespeare and Milton as lessons; and they were the lessons, too, which required most time and trouble to 'bring up,' so as to escape his censure."

In this master's lessons we trace much of that common good sense which has altered so largely the diction and style of modern English poetry. "In our English compositions," says Coleridge, "he shewed no mercy to phrase, metaphor, or image, unsupported by sound sense; or when the same sense might have been conveyed with equal force and dignity in plainer words. Lute, harp, and lyre; muse, muses, and inspirations; Pegasus, Parnassus, and Hippocrene, were all an abomination to him. 'Pierian spring, boy,' he used to say, 'I suppose you mean the cloister-pump!' 'Harp! lyre! boy, I suppose you mean pen and ink.'" This sensible master sent his boys, however, to the University, excellent Latin and Greek scholars, and tolerable Hebraists. One master in a thousand, one might say. Coleridge was attracted, too, very much at this period by the sonnets of Mr. Bowles, "a style of poetry," as he says, "so tender and yet so manly; so natural and real, and yet so dignified and harmonious," that they exercised a genial influence and an undisputed sway over his mind for a time.

At College he was "indifferent and indolent;" still, he gained the medal for the best Greek ode; but after three years residence, he left without taking any degree. It is said, he fell for a few months into evil courses; at all events, he left in despondency, perhaps in debt, and enlisted in London in a cavalry regiment. His friends soon procured for him a discharge; and in June, 1794, he paid a visit to Oxford, when for the first time he met Southey. This acquaintance put an end to all bad habits, and indeed seems to have been the turning point in his life. In the autumn, at Bristol, he again met Southey; and the two young friends discussed their scheme of establishing Pantisocracy, a model settlement, on the banks of the Susquehanna. He also engaged himself to a sister of Southey's future wife,—and in October was married to her. At this time he assayed to become a Unitarian preacher at Bristol, and projected a periodical called the "Watchman," which had an existence of only three months. The preachership fell through, and disappointed his

friends; for his first two sermons were two old lectures—one on the Hair-powder Tax, the other on the Corn Laws.

In April of 1796, his first volume of Poems was published; and at the end of that year, having suffered much from poverty and his own utter thriftlessness, he went to live at Nether Stowey, in Somersetshire, in order to be near Mr. Wordsworth. At the same time a friend came to live with him, and relieved him from much anxiety about money-matters; and in the following year Coleridge's best poetry was written, in this quiet village home. To find how it came to be written, we must go to his own account of it, which he gives so graphically in his *Biographia Literaria*. "The first year that Wordsworth and I were neighbours," he says, "our conversations turned frequently on the two cardinal points of poetry—the power of exciting the sympathy of the reader, by a faithful adherence to the truth of nature; and the power of giving the interest of novelty by the modifying colour of the imagination. The thought suggested itself that a series of poems might be composed of two sorts. In the one, the incidents and agents were to be, in part at least, supernatural. The excellence aimed at was to consist in interesting the affections by the dramatic truth of such emotions as would naturally accompany the situations, supposing them real." Coleridge's share in the work was to be confined to this—to pourtraying persons and character supernatural, or at least romantic, so as to transfer from our inward nature a human interest, sufficient to procure for these shadows of imagination that willing suspension of disbelief for the moment which constitutes poetic faith. Mr. Wordsworth, on the other hand, was to have this object—to give the charm of novelty to things of every day, by awakening the mind from the lethargy of custom, and directing it to the loveliness and the wonders of the world before us. "An inexhaustible treasure," says Coleridge, "but for which, in consequence of familiarity, we have eyes that see not; ears that hear not; and hearts that neither feel nor understand." Thus originated the joint volume of poems called "Lyrical Ballads;" and in 1798 it was published, Coleridge's contribution to it being *The Antient Mariner*, and a few minor poems. Wordsworth was so much more industrious, that his friend had not time to finish

another poem which he had been preparing for the volume—*Christabel.* The second edition contained Wordsworth's celebrated Preface.

Certainly the best poetry which Coleridge ever wrote was this, written in the Somersetshire village. In this sense he was hardly one of the Lake Poets; but this name was given to him in common with Wordsworth and Southey, a few years afterwards, after the removal of the three friends to Cumberland. Indeed, if we regard the name as being the designation of a "school" which revolutionized the current ideas of poetry, Coleridge was never anything else but a "Lake Poet," widely as he differed from the others.

Coleridge's place amongst poets is indisputable. Mr. Hort says: "One of the most common complaints against him is, that he quitted a sphere in which he was so pre-eminently fitted to shine, for others in which a poetic mind cannot but go astray. The few pages of Philosophical Poetry which he wrote, are not at all characteristic of him. It is not by this kind of poetry that he has made good his claim to be ranked amongst poets. His dramatic compositions were still less successful." "It is by his Odes, and still more by his Ballads, that he must at last be judged." For two main articles of his literary creed, the absence of arbitrary treatment in all true poetry, and the worthlessness of artificial diction, we saw that he was largely indebted to his school-master; for the halo of beauty and fascination which is thrown round his best compositions, *The Antient Mariner*, *Christabel*, and the ballad on *Love*, he was indebted to nothing but his own brilliant imagination. And it is undoubtedly this gift which makes us all acknowledge the true poet in him. "His place," says Swinbourne, "is amongst the highest of all time. The highest lyric work is either passionate or imaginative. Of passion Coleridge had nothing; but for height and perfection of imaginative quality, he is the greatest of lyric poets. This was his special power, and this his special praise."

If you wish to see what Coleridge makes of this "fusing power of the Imagination," as he calls it, I would refer you to the *Biographia Literaria*, chapters 13 and 14. It was his own chief excellence to possess it; and when he was at work on the Lyrical Ballads, he set

himself to unravel what it was, and what it signified. Thus he arrived at his doctrine of the Imagination, and the essential distinction between it and Fancy. To make much of these subtle psychological inquiries, would only mystify and weary you. The Imagination, in brief, was denied to be the maker of images; and Imagination was the proper organ of poetry. So was overturned the current criticism, which believed poetry to consist in the use of eloquent or sublime metaphors and similes. He tells us how he was impelled to answer the question—What *is* Poetry? by his strong feeling of Wordsworth being so real a poet; and yet of his being so entirely free from what had usually been considered the marks of one. He arrived at the conclusion by this process—that true poetry deals with the world of sense and its manifold contents, only so far as they are symbols of corresponding realities in the world of spirit. The first work of the Imagination is to read the symbolic language of nature. This is the proper sphere in which Imagination moves; and the poet, possessing this gift above other men, sees every object more truly and completely than is possible to the unimaginative eye; and paints nature, not absolutely, but as contemplated by man; a being who belongs to both worlds at once, and is capable of beholding glimpses of the one reflected from the unconscious face of the other. With two or three vivid strokes, e.g. in some of his own poems, a scene flashes entire into his reader's imagination, where others with less intensity would have laboured long in creating the same impression. "The Imagination dissolves," he says, "diffuses, dissipates, in order to re-create; or where this process is rendered impossible, yet still at all events, it struggles to idealize and unify; it is essentially vital, even as all objects are essentially fixed and dead." The Fancy he dismisses in a few words. "It is indeed," he says, "no other than a mode of memory, emancipated from the order of time and space, blended with and modified by choice." Let me give you two or three passages of his own, which serve to show that he possessed these gifts in no ordinary measure:—

> "Down dropt the breeze, the sails dropt down,
> 'Twas sad as sad could be;
> And we did speak, only to break
> The silence of the sea!

All in a hot and copper sky,
The bloody sun, at noon,
Right up above the mast did stand,
No bigger than the moon.

Day after day, day after day,
We stuck; nor breath, nor motion:
As idle as a painted ship,
Upon a painted ocean."

Or again:—

"'Twas not these souls that fled in pain,
Which to their corses came again,
But a troop of spirits blest.

For when it dawned, they dropped their arms,
And clustered round the mast;
Sweet sounds rose slowly through their mouths,
And from their bodies past.

Around, around, flew each sweet sound,
Then darted to the sun;
Slowly the sounds came back again,
Now mixed, now one by one.

Sometimes a-dropping from the sky,
I heard the skylark sing;
Sometimes all little birds that are,
How they seemed to fill the sea and air,
With their sweet jargoning.

And now 'twas like all instruments,
Now like a lonely flute;
And now it is an angel's song,
That makes the heavens be mute.

It ceased: yet still the sails made on,
A pleasant noise till noon;
A noise like of a hidden brook,
In the leafy month of June;
That to the sleeping woods all night,
Singeth a quiet tune.

Besides this essentially poetic gift of Imagination, I must not forget to mention another characteristic of Coleridge's poetry. This, however, has more to do with the form, than of the subject matter; and therein, too, we trace a vast influence which he has had upon the poetry of the times that came after him. He restored music to metre. "In the hands of that polished school," says Mr. Hort very happily, speaking of the 'Poets of Man,' "the art of versification consisted in cutting down the pleasant hilly road into a level or decorously inclined railway, along which the voice slid with gathering momentum to the grand shock at the final goal." One great mechanical change made by Coleridge, was of itself a thorough revolution: reckoning by *accents* instead of syllables. By introducing at the same time new forms of metre, he became indirectly the fashioner of the best known poetry of this century; the originator of some of the most charming compositions of Byron; of all those of Walter Scott. In the "Hints from Horace," Byron expressed his preference for the octosyllabic metre:—

> "Tho' at first view, eight feet may seem in vain,
> Formed, save in ode, to bear a *serious* strain;
> Yet Scott has shown our wondering isle of late,
> This measure shirks not from a theme of weight;
> And, varied skilfully, surpasses far
> Heroic rhyme, but most in *love* and *war*:
> Whose *fluctuations*, tender or sublime,
> Are *curbed too much* by long recurring rhyme."

Lord Byron admits here that he borrowed from Scott this measure, as Scott, in his turn, confessed to have derived it from the *Christabel* of Coleridge.

In 1798, after the publication of his best poems, Coleridge was rescued from much pecuniary embarrassment by the kindness of the two celebrated potters, Josiah and Thomas Wedgwood. He had before this, during his residence at Nether Stowey, been subsisting by writing articles and verses for the London newspapers and magazines, till a friend coming to live with him, relieved him in some degree; but now these generous benefactors wished the poet, whom they so much admired,

to complete his education by foreign travel, and by means of the pension they offered him, be enabled to restrict himself to literary work. Coleridge therefore started for Germany, in company with his friend Wordsworth, in the autumn; and I must recommend you to read at the end of his *Biographia Literaria*, the letters in which he describes so inimitably the incidents of the voyage to Hamburg, and the subsequent tour. They had letters of introduction to Klopstock, and many talks with him about poetry. They attended Blumenbach's lectures on natural history, and Eichhorn's on the New Testament. Coleridge learnt Gothic and German, and made his first acquaintance with German philosophy. Late in 1799 he returned to England, and in July, 1800, he came with his family to Greta Hall, where he lived for nearly the next four years. There is a letter dated April in the following year, in which he describes Greta Hall to Southey, and urges him to join them. This was done, and for a time the two families resided together in that house, so familiar to us all here. Coleridge had married, as you know, some years before this, Miss Sarah Fricker, a sister of Mrs. Southey's,—he had when he came with her to Greta Hall, two living children. Hartley, the eldest, was born at Bristol, and was now four years old. Derwent was born in 1800. A second child, Berkeley, had been born at Nether Stowey, but only lived a year. Sara was born at Greta Hall in 1802. The reminiscences of his gifted daughter Sara, as to her early home, are very interesting—for she continued to live on here with the Southeys and her mother, till her marriage in 1829.

"Two houses inter-connected under one roof," she describes Greta Hall. "The larger part of which my parents and my uncle and aunt Southey occupied, while the smaller was the abode of Mr. Jackson, the landlord. It was built on a hill, on one side of the town of Keswick, having a large nursery garden in front. The gate at the end of this garden opened upon the end of the town. A few steps further was the bridge over the Greta. At the back of the Hall was an orchard of not very productive apple-trees and plum-trees. Below this a wood stretched down to the river side. A rough path ran along the bottom of the wood, and led on the one hand to the carding-mill field, which the river near by

surrounded; on the other hand the path led below the forge field on to the forge. Oh! that rough path beside the Greta! how much of my childhood, of my girlhood, of my youth was spent there! There was a room," she continues, after describing the arrangement of the house, "which used to be my father's study, called the organ-room, from an old organ which Mr. Jackson placed there." But Coleridge was not much at Greta Hall after the year 1804. He fancied the climate did not suit his health, and went to Malta on a visit. While there he obtained the place as Secretary to the Governor, and received for his services £800 a year. We next hear of him at Syracuse, then at Naples, then at Rome and Leghorn, returning to Keswick in 1806—though no longer to be much his home, for he was oftener staying at Grasmere with the Wordsworths.

"How gravely and earnestly used S. T. C.," says his daughter, speaking of these times, "and W. Wordsworth and my uncle Southey, to discuss the affairs of the nation, as if it all came home to their business and bosoms; as if it were their private concern! Men do not canvass these matters now-a-days, I think, quite in the same tone. Domestic concerns absorb their deeper feelings; national ones are treated more as things aloof—the speculative, rather than the practical." She has interesting reminiscences, too, of her father's domestic notions, of this period. "My father had particular feelings and fancies about dress. He could not abide the scarlet socks which Edith and I wore. I remember going to him, when mamma had just dressed me in a new stuff frock: he took me up and set me down again without a caress. I thought he disliked the dress. He much liked everything feminine and domestic, pretty and becoming, but not fine-ladyish. My uncle Southey was all for gay, bright, cheerful colours, and even declared he had a taste for *the grand* in half jest. Mr. Wordsworth, too, loved all that was rich and picturesque, light and free, in clothing; he wished that white dresses were banished, and that our peasantry wore blue and scarlet, and other warm colours, instead of sombre dingy black, which converts a crowd that might be ornamental in the landscape, into a swarm of magnified ants. My father admired white clothing, because he looked at it in reference to woman, as expressive of her delicacy and purity, not merely as a component part of a general picture."

He had a kind heart too, withal. Sara, as a child, used to be terrified at night with things she had heard spoken about: with lions, the ghost in Hamlet, the picture of Death at Hell Gate, in an old edition of *Paradise Lost*; and last, and worst of all, with her uncle Southey's ballad horrors—above all, the "Old Woman of Berkeley." "Oh!" she says, "the agonies I have endured between nine and twelve at night, before mamma joined me in bed, in presence of that hideous assemblage of horrors, and the horse with eyes of flame." Her uncle only laughed; but her father understood the case better: "He insisted that a lighted candle should be left in my room, in the interval between my retiring and mamma's joining me. From that time forth my sufferings ceased. I believe they would have destroyed my health had they continued."

During this period of ten years, in which it is by no means easy to follow his movements, Coleridge delivered his celebrated Lectures on Poetry and Fine Arts at the Royal Institution. Those on Shakespeare and Education achieved the widest distinction. This line of authorship he continued in the review of Wordsworth's poetry, so able, so penetrating, so lucid, which we find in the second volume of the *Biographia*. And it was his excellence in this respect as a lecturing critic, which in a short time afterwards gained him the pension of £105 a year from George IV. as an Academician of the Royal Society of Literature. His great reputation as a critic of poetry and æsthetics is founded upon the courses of Lectures delivered at this period, and upon his "written recastings of their purport." He spoke from notes; but frequently, and at considerable length, launched out into extempore discourse.

The publication, of this time, of most importance, however, was the *Friend*, which came out in 1809, in a periodical form; and this was followed by many contributions to the *Courier*. "My father," says Sara Coleridge, "used to talk to me with much admiration and affection of Sarah Hutchinson, Mrs. Wordsworth's sister, who resided partly with the Wordsworths, partly with her own brothers. At this time she used to act as my father's amanuensis: she wrote out a great part of the *Friend* to his dictation."

Soon after the successful acting of his drama, "Remorse," at Drury Lane, which, by the bye, met with this success through the good offices of Lord Byron, Coleridge went to live at Calne, and here collected the poems called "Sibylline Leaves," (newspaper poems, reprinted under this name,) wrote the "Lay Sermons," and most of the *Biographia Literaria.* And then we come to his distinctly last period, and the home which for his last sixteen years may be said to have been the anchorage of his storm-tossed and wandering life.

Everyone has heard of Coleridge as an opium-eater. It is uncertain when he first began the habit; but when a boy at school, imprudent exposure to wet and cold, brought on the illness from which he suffered much in after life—rheumatism. And it is said that he began the terribly fascinating practice of taking opium, from seeing a medical notice of Kendal's Black Drop, as a cure for rheumatism and diseased action of the heart. "The medicinal virtue of the drug appeared at first almost magical." There is no reason to suppose that he weakly yielded to it, as a mere sensual gratification. With the exception of a few months, on his leaving college, Coleridge's life had been a singularly blameless one, and free from vice. He was not a man who would rush headlong into a course such as this; but the fascination of opium, begun from motives entirely innocent, as is well known, binds its victim with cords, that many a stronger man than Coleridge has been unable to break. In 1814 he confesses "a sad retrogress of twelve years;" but he may have begun the practice before this century, and have overcome it partly. Mr. Gillman, one of his biographers, dates it from the attacks of rheumatism in his school days; from swimming over the New river in his clothes, and remaining in them. "From these indiscretions and their consequences, may be dated," he says, "all his bodily sufferings in future life." If we add, that he gained a slow victory over the baneful and self-detested habit after he went to live with Mr. Gillman in 1816, we shall not be harsh in our estimate of this unfortunate practice. Anyhow, in 1816, the fatal habit had gained such an ascendancy over him, that his friend Dr. Adams, persuaded him to place himself in the house, and under the care and supervision, of a medical man. This was the origin of his

going to Mr. Gillman's at Highgate, where, I believe with the exception of visits to Oxford in 1820, and to Cambridge to a meeting of the British Association in 1833, and also a tour in Holland and Belgium, undertaken in 1828, he lived constantly till his death. "At Highgate," says another biographer, "he conquered his habit of taking opium, though he never before had gone sixty consecutive hours without taking it. He cultivated his flowers, and had a set of birds as pensioners. He was not apparently sad, though there are ample evidences in his writings of deep-seated dissatisfaction with himself, and with the comparatively slight life-long results of his spacious, splendid, and various intellect." "His extraordinary powers of conversation, or rather 'monologue,' now found ample exercise; there were many, and some half-worshipping, listeners to the oracular and super-abundant utterances which flowed on for hours." Nor must we suppose that those who rather severely handled this "monologue," and from their dislike of metaphysic, would sometimes call it "bottled moonshine," were unjust and unfair to the real flashes of genius which now and again were apparent enough. "Glorious islets, too," says Carlyle, "I have seen rise out of the haze. Balmy sunny islets, islets of the blest and the intelligible; on which occasions the secondary humming groups would cease humming, and hang breathless upon the eloquent words. Eloquent, artistically expressive words you always had: piercing radiances of a most subtle insight came at intervals: tones of noble pious sympathy were never wanting long."

In the year he came to London (the only wonder is that he had the energy to write anything,) the "Two Lay Sermons" were written; his Autobiography in the following year; his "Aids to Reflection" in 1825; and his "Church and State" in 1830.

This literature introduces us to those other departments, besides poetry, in which Coleridge was certainly great. I must say something to you of his Philosophy and of his Theology, though there is but little space left to deal with such vast and formidable subjects. His political ideas began by being eminently visionary: he thirsted for liberty, in a way which we, who know what it is so well now, can scarcely conceive. It was a much less familiar thing in Coleridge's youth; and when the

great outburst of the French Revolution came, that dawn of the new epoch for Europe, he rejoiced in it, and threw into its cause all his youthful enthusiasm. Gradually as life went on, as he became older, and knew more what the world is, his enthusiasm cooled down. The terrible crimes which dyed with blood the advancing times of the great change; its tremendous wrenches and excesses and throes, in escaping from the past; its trampling under foot all that man's spirit had ever carved out for itself as dear and venerable, perhaps disgusted his gentle nature; and as his years went on, he sank into an acquiescent, if not a vehement admirer of established modes of carrying on the world's business. Perhaps he never, like Southey, became a Tory; he loved liberty to the end; but he saw better and more clearly how only it could be gained and kept. He wrote essays in his latter days on the Constitution of Church and State; but he never advocated stagnation and absolute conservativism. He taught that there must always be progress, but that the progressive and permanent elements in a State should work together. While advocating rights and realities of property, he acknowledged the majesty and supremacy of law. But I don't know that these changes of mind are worth dwelling upon, or indeed, that they are in any way uncommon. What we see taking place in Coleridge, I think, we see taking place in a vast number of minds. The great majority of thinking men get to know in time, that all changes must be brought about gradually and slowly, if the improvement is to be permanent; and they get to see that rushing headlong into the future, and dashing one's head against the strong wall which the spirit of the time has thrown up, never succeeds. It is only by slow and patient sapping and mining that the walls of human prejudices ever come to fall. The enthusiasm of youth invariably gives way to the clearer and calmer insight of advancing life, and at last we learn that hard lesson—waiting patiently.

Mental Philosophy always had more attractions for Coleridge than any other kind. He was above all things a metaphysician. There are many different ideas as to the possibility of anything worthy the name of science in this region. Certainly, a survey of what has been thought and written and said about the science of mind, is not encouraging. Perhaps

we are, as speculators, but little more knowing than Aristotle was two thousand years ago, as to the origin of all knowledge and all ideas. While at Cambridge, Coleridge admired more than all other philosophers — Hartley and Berkeley. In after years his admiration of them continued, for he named after them his two eldest boys. But he must have changed afterwards, for when he comes to speak in his *Biographia* of this year, 1797, he says: "After I had successively studied in the schools of Locke, Berkeley, Leibnitz, and Hartley, and could find in none of them an abiding place for my reason, I began to ask myself—Is a system of philosophy, as different from mere history and historic classification, possible? If possible, what are its necessary conditions? I was for a while disposed to answer the first question in the negative, and to admit that the sole practicable employment of the human mind was to observe, to collect, and to classify." It might have been well for Coleridge's philosophy, if he had stopped at this point. If instead of dreaming of what cannot be verified, he had turned some of that great genius, and even that splendid imagination, to the work of real science, that which is alone worthy of the name: that of which Bacon is the immortal guide; that which has done more for man, and aided his progress and enlightenment and happiness, more than all the philosophies of the past world put together; that unravelling and reading of the marvellous universe which surrounds us, but of which it may be said we have only just begun to cut the first pages of the mighty and divine book. But Coleridge's longing for mere speculation as to the mind and its workings, was too strong for him; he fell back into the endless mazes of ontology. Lessing and Kant and Schelling, in his later days, were his most loved and revered authorities. From the second of these gifted men, he is usually understood to have borrowed that doctrine which is so eminently Coleridgean in this country—the distinction between the Reason and the Understanding. Doubtless there were differences between the system which Kant taught on the one hand, and Coleridge on the other; but in this point they were agreed—"The Understanding is a lower faculty, which only collects ideas, ('disconnected and helpless notions,') and supplies them as materials for the great combining faculty—*pure Reason*."

He found here the assurance that man's reasoning—or rather, understanding—powers, are not man himself, and that he may rise above their impotence, and have direct faith in unseen realities. He seems to have differed from the German philosopher in denying that the Reason is, as it is with him, only a faculty of individual men, and not rather a divine nature of which all are partakers, and that equally.

The Reason instructs by intuition—divine insight; it is in the same region, and allied to his Imagination, which sees in the things of the external world only symbols of the unseen. It does many other wonderful things; but it is difficult to feel quite sure, when you are treading this ground, that you are not dealing only with ingenious inventions and fanciful conceits. Some minds have but little taste for speculations which can never be profitable, and are always conflicting. There are as many systems, indeed, of mental philosophy, as there have been teachers and professors of it. Hardly two have thought alike. Let us admire their courage and their ingenuity. I can hardly ask you to follow me through any more of Coleridge's speculative teaching; the very phraseology becomes wearisome to our ears; the perpetually recurring ego and non-ego—the object and the subject—the real and ideal—the identity of knowledge and being, and much more, all conveying to the ordinary mind very little meaning, and to the instructed mind only the idea of endless intellectual battle-fields.

Coleridge at last thought he saw in Schelling's writings a coincidence with his own imperfect results. The teaching of both was Objective Idealism, which term will certainly want interpreting. So far as I can interpret it, it means, divested of technicalities, something of this sort—Beside the Subject, there must exist an Object; the two are identical in a third, which is the Absolute. This Absolute is neither Ideal nor Real —neither mind nor Nature—but both. The Absolute is God. He is the All in All: the eternal source of all existence. He realises Himself under one form as Objectivity, and under a second form as Subjectivity. He becomes conscious of Himself in man; and thus man, under the highest form of his existence, manifests Reason; and by this Reason God knows Himself.

So does Coleridge's Philosophy lead us directly down to his Theology. The one with him was indeed almost identical with the other. He began his thoughtful life, as we saw, by being a Unitarian, and a great admirer of Spinoza. His *Religious Musings* are a fair specimen of his religious ideas at the time of his leaving Cambridge; and these are tinctured with Spinozism to a considerable extent. Afterwards he gives up Unitarianism, and accepts the doctrine of the Trinity. He is careful to tell us, that he does not think he could have arrived at that doctrine from the reasoning process alone; but that having been *revealed*, he sees at once its truth in its coincidence with philosophy. There is Absolute Being when, as we saw, the Subject and Object become identified. The Infinite, which manifests itself in the Finite, in the Creature. But Ideas are but emanations from the Infinite. Knowledge and Being are one—i.e.—the Father and the Logos of the Christian Trinity are absolutely one. But there is also a result of this combination, that is—energy, that is—active Love. From Being and Knowledge proceed Energy—i.e.—the Holy Spirit proceeds from Father and Son. Again—Ideas and Conceptions are distinct; *ideas* are flashes from the Universal Light; *conceptions* are the abstract images and definitions of things drawn by each man's particular understanding. By the *pure reason*, man holds communion with God; it is not only closely allied to Imagination—the maker of poets and prophets—but it is a spiritual and intuitive faculty. By virtue of *it* (the Light which lighteth every man), man has *faith*. The individual recognizes as true, by this precious gift, the revelations of the Logos. So again, Inspiration or Revelation, is that which brings home the voice of the Infinite, of God, to the heart. The statements in the Bible, which are true, commend themselves at once to the Intuitive Reason. This is the "verifying faculty," by which our Faith or Reason is able at once to distinguish between true and false, between the gold and the dross. Or, once more—The voice of the divine Reason in regard, not to faith, but to duty or conduct, is ever heard in the conscience; hence, whatever truth man has to tell, is the same in all times. Poets and philosophers, by listening to and interpreting the Imagination and the Reason, have the

same truths to tell with prophets and apostles; in all the Reason, or Logos, within them, is the revealer of God's Eternal Truth. So it was, too, that Coleridge at last possessed intense reverence for the wisdom of the past. In it he recognized the instincts and intuitions of humanity. Adulterating ingredients, no doubt, he saw in it all; but yet, beneath all, a germ of eternal truth: the Spirit guiding into all truth. The Catholic dogmas, he felt, were to be interpreted in this way; and always recognizing the truth which underlay them, he would have had all men to pay reverence and respect to the substructure, however much they might repudiate the false glitter and meretricious ornament of the superstructure.

These grand ideas, by filtering through the minds of many who sat at his feet, have influenced widely and deeply the religious thought of our time. Chiefly interpreted, no doubt, by Hare and Maurice and Kingsley, they have had a far wider extension; and it is plain, have modified the ideas of those who would be most loud in disclaiming their influence; and have, we may hope, paved the way for a higher, purer, more enlightened, more loving Church of the future. It may be dangerous to say more on this subject; but let us be just to Coleridge at all events, and accord him all that we believe to be his most distinctive praise.

For four years he was almost confined to his own room; four years, no doubt, somewhat dreamily and weakly spent, but still with intellectual life beneath the bodily weakness, making itself known and felt. Troubled nights and restless days came to him, caused by changes in the structure of his heart; and on July 25th, 1834, this great, and yet troubled spirit, passed quietly away. No one is better able to speak of him and his character, than his daughter; and she says in a letter to a friend: "In his death we mourn not only the removal of one closely united to us by nature and intimacy, but the extinction of a light which made earth more spiritual, and heaven in some sort more visible to our apprehension."

TRANSACTIONS

OF THE

CUMBERLAND ASSOCIATION

FOR THE

Advancement of Literature and Science.

PART III.—1877-78.

EDITED BY J. CLIFTON WARD, ASSOC. R.S.M.,
Fellow of the Geological, Mineralogical, and
Royal Microscopical Societies.

PRICE TO MEMBERS, ONE SHILLING.
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RULES

OF THE

CUMBERLAND ASSOCIATION FOR THE ADVANCEMENT OF LITERATURE AND SCIENCE.

——:o:——

1.—That an Association be formed to be called the "CUMBERLAND ASSOCIATION FOR THE ADVANCEMENT OF LITERATURE AND SCIENCE."

2.—The Association shall consist of all members of the following Societies:—Whitehaven Scientific Association, Keswick Literary and Scientific Society, Cockermouth Literary and Scientific Society, Workington Scientific and Literary Association, Maryport Literary and Scientific Society, Longtown Literary and Scientific Society, Carlisle Scientific Society and Naturalists' Field Club, Ambleside and District Literary and Scientific Society, and of the members of such other Societies as shall be duly affiliated. Also of persons not belonging to any of the affiliated Societies, if nominated by two members of the Council; this latter class of members shall pay the sum of 5s. annually.

3.—The Association shall be governed by a Council, consisting of a President, Vice-Presidents, Secretary, Treasurer, and of ordinary members, two to be elected by each affiliated Society.

4.—The President, Secretary, and Treasurer shall be elected annually at the Annual Meeting, and be capable of re-election.

5.—The Vice-Presidents shall consist of the Presidents of the various affiliated Societies; and the delegates of the various Societies shall be elected annually by their respective Societies.

6.—An Annual Meeting of the Association shall be held at such time and place as may be decided upon at the previous Annual Meeting, or (failing such appointment) as may be arranged by the Council.

7.—At each Annual Meeting, after the delivery of the President's Address, and the reading of the Reports from the affiliated Societies, the objects of the Association may be furthered by Lectures, Papers, Addresses, Discussions, Conversaziones, &c. The Council shall have the power of obtaining the assistance of persons who are not members of the Association.

8.—The Council may publish at the expense of the Association such portions of its own or any of the affiliated Societies' communications as may be deemed advisable, subject to the consent of the author.

9.—The Council shall endeavour to promote co-operation among existing Societies, and may assist in the formation of new ones; it may also aid in the establishment of classes in connection with any of the associated Societies.

10.—Affiliated Societies shall contribute towards the general funds of the Association the sum of Sixpence for each member.

11.—The Rules can only be altered by a majority of two-thirds of the members present at an Annual Meeting. Any member

desiring to alter the rules must send a copy of the proposed alterations to the Secretary, at least two weeks before the meeting is held.

12.—Past Presidents of the Association shall be permanent members of the Council, and be described as Past Presidents.

13.—The travelling expenses of all who assist in carrying out the programmes of the various affiliated Societies shall be defrayed by the Society assisted.

The Fourth ANNUAL MEETING will be held at Workington in the month of May next, and due notice of the arrangements for the same will be issued to all members of the Association.

Members willing to bring forward Papers on subjects of original investigation or of local interest should send in the titles of the same to the Secretary.

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HOWGILL STREET.

11th SESSION, 1877-78.

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Geological, Mineralogical ... ... R. PICKERING. R. RUSSELL.
Archæological ... ... T. F. I'ANSON. W. JACKSON.

Treasurer ... ... J. S. HELLON.
Hon. Librarian ... ... C. M'GLASHAN.
Hon. Secretary ... ... B. TAYLOR.

The following MEETINGS were held during the Session:—

Oct. 9.—CONVERSAZIONE.—The PRESIDENT'S ADDRESS.

Oct. 23.—J. D. KENDALL, W. H. KITCHIN, J. NIXON, B.A.—Theory and Practice considered in Relation to each other.

Nov. 6.—W. M. MOORSOM, B.A.—General Sketch of Political Economy. (1.)—Wealth; what it is, and a few facts about it.

Nov. 20.—T. V. Holmes, F.G.S., H.M. Geological Survey.—The Chalk ; its origin, characteristics, and scenery.

Dec. 4.—J. S. Ainsworth, M.A., LL.B.—General Sketch of Political Economy. (II.)—The Production and Distribution of Wealth.

Dec. 18.—C. Smith, F.G.S.—President of the Barrow Naturalist's Field Club.—Boulder Clay.

Jan. 8.—T. F. I'Anson, M.D.—How an Animal is built up. (I.)—Bone and Muscle.

Jan. 15.—J. E. Taylor, F.G.S., (Ipswich.)—Flowers : their shapes, perfumes, and colours.

Jan. 22.—A. A. H. Knight. M.D., (Keswick.)—How an Animal is built up. (II.)—The Organs of Circulation and Respiration.

Feb. 5.—J. Adair.—A Trip to Ennerdale. R. Pickering.—The Submerged Forest at St. Bees.

Feb. 19.—H. Barnes, M.D. (Carlisle)—How an Animal is built up. (III.)—Brain and Nerves.

Mch. 5.—W. Alsop.—The Introduction and Progress of Printing in England.

Mch. 19.—Rev. W. H. Wilkinson.—The Study of Words.

Apl. 2.—J. Main, M.E.—Gravitation.

Apl. 16.—J. Vivian, C.E.—The Past and Present of Mineral Research.

Apl. 30.—Conversazione.—Business Meeting. Election of Officers, &c.

———:o:———

Two SPECIAL COURSES of LECTURES were also given on the following Subjects :—

Six Lectures on Light and Spectrum Analysis.—A. Kitchin.
Six Lectures on Geology.—R. Russell.

The session commenced as usual with an opening conversazione which was very numerously attended, and the committee have to acknowledge the assistance and support which they received from members of the association and others who kindly lent objects for exhibition on the occasion. At that meeting one of the most recent discoveries in science was brought before the association, viz., the transmission of sound by means of an induced magnetic current. These experiments with the Telephone were amusing and instructive. The number of members at present amounts to 269, nearly the same as at the close of last session. The new members admitted during the present session were 45 in number. By way

of experiment in one of the meetings a special subject was selected, and treated controversially by three gentlemen. These papers were of a very interesting character. The committee would recommend that in future more papers of a similar character should be read. Two evenings were devoted to local subjects. The paper by Mr. C. Smith, F.G.S., on "Boulder Clay," is worthy of note for some suggestions made in the introduction. These referred to the desirability of some joint action being taken by the Whitehaven Scientific Association and the Barrow Naturalists' Field Club for the encouragement of original work, especially in connection with subjects pertaining to our own neighbourhood. This subject was also mentioned in the president's address at the commencement of the session, but no definite action in this line has yet been taken by either society. Two local papers were read—"A Trip to Ennerdale," by Mr. J. Adair; and "The Submerged Forest at St. Bees," by Mr. R. Pickering. These papers do not appear in the original programme, but were substituted for that promised by the Right Hon. G. C. Bentinck, which he was unable to read at the appointed date. It is to be hoped that during next session we may have the honour of hearing this paper read. There were also two lectures on "Political Economy," and three lectures on physiological subjects. The attendance at the lectures on "How an Animal is Built up," was decidedly more numerous than was the attendance on a somewhat similar series given during the session of 1876-77. These lectures were highly instructive, and being given in a popular manner, must have conveyed much valuable information to those who were really desirous of such instruction. As the pursuits and tastes of the members are so varied, it may not be justifiable for your committee to extend this system to any very great length. All the other papers read during the session were of a varied and interesting description. To gentlemen who have prepared and read papers to the association during this session, the best thanks of your committee are due. When the time and labour which must be devoted to the preparation of these papers are taken into consideration, we cannot too highly appreciate their disinterested kindness. The attendance at the meetings generally during this session has

been good. Still, out of our large membership the attendance on all occasions might be more numerous. Two special courses of six lectures each were also given, at the request of some of the members of this association. The attendance at these meetings was as large as could reasonably be anticipated. Various articles and specimens have been presented to the museum during this year. To the donors the curators have to express their very best thanks. Your committee think that if the funds of the association would allow of a little more money being devoted to museum expenses, an earnest attempt should be made to classify and arrange the collections already in our possession, and also to increase them still further. On the occasion when the Westmorland and Cumberland Archæological and Antiquarian Society visited Whitehaven in December last, your committee invited the members to a conversazione. The invitations were confined to members of the two societies, and the conversazione was held in the Association Rooms, Howgill-street. Our guests expressed themselves thoroughly pleased with the entertainment which was provided for the evening, and also wished their thanks to be conveyed to the association for the use of the rooms on the following day. The papers then read were of very great local interest.

KESWICK LITERARY AND SCIENTIFIC SOCIETY.

9TH SESSION, 1877-78.

President	J. FISHER CROSTHWAITE.
Vice-President	J. CLIFTON WARD, F.G.S.
Secretary	W. WOOD.
Treasurer	J. FISHER CROSTHWAITE.

Committee.

Rev. CANON BATTERSBY, M.A.	A. H. KNIGHT, M.D.
Rev. ALFRED HOWSON.	E. J. GRAYSON.
Rev. W. COLVILLE.	R. R. LOWTHIAN.
Rev. GEO. L. B. WILDIG, B.A.	J. BIRKETT.

MEETINGS HELD DURING THE SESSION.

SUMMER FIELD MEETINGS.

June 27.—Excursion to the Roman Station called Cær-mot, near Bassenthwaite, conducted by Mr. J. FISHER CROSTHWAITE.

August 2.—Archæological Excursion to Hutton-John and Dacre Castle, conducted by Mr. J. FISHER CROSTHWAITE.

Aug. 29.—Geological Excursion to Greenup Gill and Eagle Crag, conducted by Mr. J. CLIFTON WARD, F.G.S.

(This was in connection with the Maryport and Cockermouth Societies.)

The above Field days were in addition to four which took place on the occasion of the Meeting of the Association in Keswick, May 1st, 2nd, and 3rd, 1877, and which are reported in the Transactions of that year.

WINTER SESSION.

ORDINARY MEETINGS.

Held in the Keswick Library at 7-30 p.m.

Oct. 22.—THE PRESIDENT—Peter Crosthwaite.

Nov. 5.—Mr. J. RICHARDSON—The Superstitions once common in the Lake District.

Dec. 3.—Open Night, for Short Papers, when Capt. JOHN JACKSON read a paper on "Self Elevation," and Mr. J. C. WARD and Mr. W. WOOD one each on the "Manchester Thirlmere Water Scheme."

Feb. 4.—Mr. THOS. MAYSON—The Character of Cromwell.

Feb. 18.—Mr. J. P. ANDERSON, B.A.—Italy in the Thirteenth Century.

Mch. 4.—Mr. WM. WOOD—The Drama and some of its Actors.

Mch. 18.—Mr. THOS. MAYSON—Printing, practically illustrated.

Mch. 25.—Mr. J. POSTLETHWAITE—Some Curiosities of the Mineral Kingdom; and the Election of Officers and Committee.

LECTURES.

Held in the Keswick Lecture Hall, at 8 p.m.

Oct. 29.—A. G. SYMONDS, Esq., M.A.—Prose, Poetry, and Music.

Nov. 19.—D. BIRKETT, Esq., F.R.I.B.A.—Originality and Individuality in Art, as shown in the Works of British Artists.

Dec. 17.—J. CLIFTON WARD, Esq., F.G.S.—Faraday.

Dec. 31.—Prof. T. MC.K. HUGHES, M.A., F.G.S.—Sedgwick.

Jan. 16.—JAS. GORDON, Esq.—How we See Things.

Jan. 21.—J. E. TAYLOR, Esq., F.L.S., F.G.S.—Geographical Distribution of Animals and Plants.

Jan. 28.—Geo. E. Lowthian, Esq.—Chemistry of Water, illustrated by Experiments.

Feb. 11.—Rev. W. Sherwen, M.A.—Words.

Feb. 25.—G. J. Snelus, Esq., Assoc. R.S.M.—The Telephone.

Apl. 1.—Rev. Geo. L. B. Wildig—The Study of History.

The Lectures and Ordinary Meetings have been fairly well attended by the members, but the Lectures have not been so well attended by *non-members* as they ought to have been, considering the character of the lectures and the low charge of admission (*1d.*) At the Ordinary Meetings the discussion of Papers was pretty well sustained.

Mr. J. Clifton Ward conducted a Natural History Class in the Museum, upon six consecutive Saturday afternoons, the subject being the "Lower Forms of Animal Life." Two Saturday night Lectures were also given on the same subject to working-men, in the Museum.

Both numerically and financially the condition of the Society is satisfactory. There are 156 members, 11 of whom are under age. Thirteen new members have been elected during the last Session.

At the commencement of the Session the subscription was raised from *2s. 6d.* to *5s.*, thus making it uniform with that of most of the other Societies.

The Museum was lighted and thrown open free to the public on Saturday evening, Dec. 1st, and microscopes were placed on exhibition round the room. Several hundreds visited the local collection on this occasion.

Though several valuable contributions have been made to the Museum during the past year, there is still much room for the efforts of local naturalists.

It is intended to hold a Bazaar in August, in aid of the funds of the local Museum and School of Art.

The Committee has purchased Flintoft's Model, which will henceforth form an important part of the local collection. The Museum is open to members and their friends free.

COCKERMOUTH LITERARY & SCIENTIFIC SOCIETY.

7th SESSION, 1877-78.

President ... ... ISAAC FLETCHER, ESQ., M.P., F.R.S.

Vice-Presidents.

REV. W. WILLIAMS, F.G.S.
HENRY DODGSON, ESQ., M.D., F.R.A.S., F.M.S.

Committee.

Mr. JOSEPH BROWN.	Mr. JOHN SIMPSON.
Rev. ELDRED GREEN.	Mr. E. L. WAUGH.
Mr. THOMAS M. HARRIS.	Mr. HORACE R. WYNDHAM.
Mr. J. H. PICKERING.	Mr. WILLIAM YOUDALE.

Secretary ... ... Mr. M. EDWARDS.
Treasurer ... ... Mr. GRAHAM.

LECTURES were delivered during the Session as follows:—

Oct. 18.—The Bessemer Process. By G. J. SNELUS, F.C.S.

Nov. 1.—Faraday. By J. C. WARD, F.G.S.

Nov. 15.—Protectorate of Cromwell. By the Rev. G. L. B. WILDIG.

Nov. 29.—Evolution as the process by which the earth has arrived at its present form. By J. D. KENDALL, C.E.

Dec. 13.—The Empire of the Incas. By J. H. PICKERING.

Jan. 10.—Dante and his Times. By R. A. ALLISON, M.A.

Jan. 17.—An Hour at the Sea-side. By J. E. TAYLOR, F.L.S., F.G.S.

Jan. 31.—Pope: his Life and Times. By the Rev. J. T. POLLOCK.

Feb. 14.—Symbolism in Art. By J. A. WHEATLEY.

Feb. 28.—History of the House of Commons. By the PRESIDENT.

Mch. 14.—The Huguenots. By Jos. BROWN.
Close of Session, Business, and Election of Officers.

The attendance at the Lectures (though satisfactory as regards the average) was unequal; that at Dr. Taylor's Lecture, given in the Public Hall, was very large.

On August 29th, the Society joined the Keswick and Maryport Societies in an excursion to examine the Glacial Moraines of Greenup Gill, Borrowdale.

An English Literature Class has been most efficiently conducted by the Rev. C. H. Gem; eight separate evenings were devoted to it; the attendance averaged thirty.

WORKINGTON SCIENTIFIC AND LITERARY ASSOCIATION.

4TH SESSION, 1877-78,

President	H. F. CURWEN, ESQ.
Vice-President	REV. J. J. THORNLEY, M.A.
Treasurer	Mr. W. WILSON.
Secretary	Mr. J. JOHNSON.

Committee.

Mr. H. BOWES. | MR. G. F. DOWNAR.
Mr. W. DEIGHTON. | Mr. J. H. HOWE.
MR. G. J. SNELUS.

The following LECTURES were given during the Session :—

Oct. 24.—R. RUSSELL, C.E., F.G.S.—Pre-Historic Man.

Nov. 7.—Rev. J. S. CRAIG.—The Ancient Icelander; his Life and Literature.

Nov. 21.—A. KITCHIN, F.C.S.—Some of the Elementary Principles of Light (experimentally illustrated).

Dec. 5.—J. CLIFTON WARD, F.G.S.—Some of the Elementary Principles of Sound (experimentally illustrated).

Jan. 16.—J. E. TAYLOR, F.L.S., F.G.S.—An Hour by the Sea-side.

Jan. 30.—Dr. HIGHET.—Reminiscences of Travel in Egypt and Syria.

Feb. 6.—JAMES BAIRD, Esq.—Some of the Elementary Principles of Heat (experimentally illustrated).

Mch. 6.—E. S. CROMPTON, Esq.—Railways: their Permanent Way and Signals.

Mch. 20.—W. W. KITCHIN, Esq.—Some Curiosities of Plant Life.

Apl. 3.—C. MC.GLASHAM, Esq.—Coral Formation.

The Committee, in presenting their fourth annual Report, have to state that the number of members on the books is about the same as last year, some old members having withdrawn and their places being taken by new ones. The attendance of members at the meetings has been very fair.

The Committee suggest that next session the course should be divided into two parts, as in some of the other Societies, one part consisting of monthly *public lectures*, and the other of *ordinary meetings*, at which short papers should be read by the members, and a discussion encouraged.

MARYPORT LITERARY AND SCIENTIFIC SOCIETY.

2ND SESSION, 1877-78.

President ... ... Mr. J. WOOD.

Vice-Presidents.

Rev. A. OATES. | Dr. CRERAR.

Secretary ... ... Mr. J. B. BAILEY.
Treasurer ... ... Mr. J. ROBINSON.

Delegates.

Rev. J. S. CRAIG. | Mr. A. HINE.

Committee.

Rev. J. S. CRAIG. | Mr. P. MACINTYRE.
Mr. J. HODGSON. | Mr. W. HINE.
Mr. R. ADAIR.

MEETINGS were held during the Session in the George Street School Room as follows :—

ORDINARY MEETINGS.

Nov. 2.—Revision of Rules, &c.
Nov. 16.—Conversazione and Exhibition.
Nov. 30.—Mr. P. MACINTYRE—Air.
Dec. 21.—Mr. R. ADAIR—Spelling Reform.
Jan. 25.—Discussion.
Feb. 22.—Mr. F. WALKER—Photography.
April 5.—Mr. J. R. CORNER—Physiognomy.
April 12.—Mr. J. B. BAILEY—Ancient Maryport.—Revision of Rules, Election of Officers, &c.

PUBLIC LECTURES.

Dec. 14.—J. CLIFTON WARD, Esq., F.G.S.—Optical Instruments.
Jan. 18.—J. E. TAYLOR, Esq., F.L.S., F.G.S.—Earthquakes and Volcanoes: their History and Origin.
Feb. 8.—T. F. I'ANSON, Esq., M.D.—On Touch.
Mch. 8.—J. CLIFTON WARD, Esq., F.G.S.—The Ear.
Mch. 29.— ,, ,, ,, —The Eye.

The Committee, in presenting this its second annual Report, is glad to notice a very satisfactory increase on last year's member-

ship. Many difficulties incident to a new Society have been encountered, but it is now hoped that a prosperous future is before the Society. With satisfaction the admission of several lady members is recorded. The attendance at both Public and Ordinary Lectures has been much better than last year.

The Conversazione and Exhibition proved a decided success, the Athenæum being engaged for the occasion. During the evening papers were read by the following gentlemen :—

Capt. CONLEY, R.N. ...	"Life-Saving, &c., Apparatus."
P. MACINTYRE, Esq.	"The Blast Furnace."
G. J. SNELUS, Esq., Assoc. R.S.M. ...	. . "The Telephone."
A. KITCHIN, Esq., F.C.S.	"The Spectroscope."

The Exhibition comprised a large and choice collection of pictures, statuettes, models, Hindoo, Chinese, Japanese, and Burmese vases, paintings, carvings, &c.

A Field-day was arranged in connexion with the Keswick and Cockermouth Societies on Wednesday, August 29th.

The *Transactions* have been given to the members free.

It is in contemplation to form a local Museum in connexion with the Society.

LONGTOWN LITERARY & SCIENTIFIC SOCIETY.

1ST SESSION, 1877—78.

President	Rev. J. J. BURROW.
Vice-President...	R. A. ALLISON, ESQ.
Secretary and Treasurer	MR. JOHN WILSON.

Committee.

Dr. GRAHAM.	Mr. E. J. MUSGRAVE.
Mr. J. RIGG.	Mr. W. LITTLE.
Mr. J. PEEL.	Mr. A. WILKIE.

PUBLIC LECTURES.

Nov. 19.—J. CLIFTON WARD, Esq., F.G.S.—Ice and the Old Cumberland Glaciers.

Dec. 10.—Rev. CANON BATTERSBY—Recent Discoveries in Ancient Assyria and Babylon.

Jan. 14.—Rev. Geo. L. B. Wildig—The Protectorate of Cromwell.
Feb. 11.—Rev. C. H. Gem—Life and Writings of Tom Hood.
Mch. 18.—T. F. I'Anson, M.D.—Water: its Forms and Forces.
Apl. 8.—Dr. Walker—Sanitation.

Ordinary Meetings.

Dec. 3.—Rev. J. J. Burrow.—Coal.
Dec. 17.—Mr. W. Hood—Education: its true Nature and Aims.
Dec. 24.—Readings by several Members.
Dec. 31.—Mr. J. Wilson—The probable effect of Shortening of the Hours of Labour.
Jan. 7.—Mr. Mc.Conochie—The Steam Engine and Printing Press.
Jan. 21.—Discussion on the Protectorate of Cromwell.
Jan. 28.—Mr. Towns—Public Health.
Feb. 4.—Discussion on Public Health.
Feb. 18.—Discussion on Tom Hood.
Feb. 25.—Rev. J. J. Burrow—A Reading on Food and Digestion.
Mch. 4.—Dr. Graham—The House we Live in.
Mch. 11.—Rev. J. J. Burrows—A Reading: The Unconscious Actions of the Brain, by Dr. Carpenter.
Mch. 25.—Mr. A. Wilkie—Plants and their Food.
Apl. 1.—Discussion on the Causes of the present Depression in Trade, and Election of Officers for the present year.

The Society has enrolled 42 members. The Meetings have been fairly well attended, and much instructive and interesting matter has been advanced.

It is intended that a Field-day shall be held in the Summer, and the Meetings resumed in Autumn.

CARLISLE SCIENTIFIC SOCIETY AND FIELD NATURALIST CLUB.

1st SESSION, 1877-78.

President ... The Right Rev. the Lord Bishop of Carlisle.

Vice-Presidents.

Robert Ferguson, Esq., M.P.
S. J. Binning, Esq., Mayor of Carlisle.

Treasurer	R. S. Ferguson, Esq.
Hon. Curator	T. K. Atkinson, Esq.
Secretary	Mr. John Sinclair

Committee.

Dr. Mc.Laren.	Mr. R. M. Hill.
Dr. Barnes.	Mr. Geo. Dawson.
Mr. C. J. Ferguson.	Mr. W. Duckworth.
Mr. W. I. R. Crowder.	Mr. John Jackson.
Mr. Baxter Smith.	Mr. W. B. Dodd.
Mr. J. B. Watson.	Mr. T. Duckworth.

Public Lectures.

Dec. 18.—The President—Inaugural Address.
Jan. 22.—J. E. Taylor, Esq., F.L.S., F.G.S.—An Hour by a Pond Side.
Feb. 19.—J. Clifton Ward, Esq., F.G.S.—The Old Glaciers of Cumbria.
Mch. 19.—Dr. Barnes—The Nervous System.
Apl. 16.—Geo. J. Snelus, Esq., F.C.S.—The Telephone.

Ordinary Meetings.

Feb. 8.—Mr. R. S. Ferguson—Some of the Contents of the Museum.
Mch. 5.—Mr. George Dawson—The Birds of the District.
Apl. 9.—Mr. Duckworth—Beetles.

The Committee of the above Society have much pleasure in presenting their first annual Report, and congratulate themselves on the success which has so far crowned their efforts. The want of such a Society in Carlisle had long been felt;—and although the Session has only been short, it has been eminently successful.

The Society was organized in December 1877, with 50 original members, and the number now on the books has reached 159.

The attendance at the Lectures and the reading of Papers has been very good, and from the interest manifested, the Committee are encouraged to hope that a still more successful Session will be possible next year.

A very considerable improvement has been made in the Museum, and many new specimens have been added to the collections.

An excellent gift of about forty volumes has been made to the reference Library, for the use of members at such times as the Museum is open.

AMBLESIDE AND DISTRICT LITERARY AND SCIENTIFIC SOCIETY.

1st SESSION, 1878.

President .. .. R. CREWDSON, Esq.

Vice-Presidents.

Rev. H. S. CALLENDER. | Rev. J. SPAVEN.

Secretary ... ... C. W. SMITH
Treasurer ... ... W. LISTER

Committee.

W. BARTON	G. GATEY
T. BELL, Junr.	E. J. HEBERT
J. BENTLEY	A. JOHNSTON, M.D.
J. FLEMING	F. M. T. JONES
W. FLETCHER	W. T. KENDALL

MEETINGS were held during the Session as follows:—

ORDINARY MEETINGS.

Held in the Lecture Room, Church Street, Ambleside, at Eight p.m.

Feb. 1.—Rev. H. S. CALLENDER, Vice-president—Introductory Address.

Feb. 15.—Mr. J. BENTLEY—Wordsworth.

Mch. 1.—E. J. HEBERT, Esq., M.A., F.G.S.—The Eye, a victim of constant deception.

Mch. 15.—Mr. W. T. KENDALL, M.R.C.V.S.—Some of the changes produced in Nature by Chemical agency.

Mch. 29.—Rev. E. M. REYNOLDS, M.A.—Debate: That the Foreign Correspondence of our Newspapers exercises a baneful influence.

Apl. 12.—R. CREWDSON, Esq., President—Concluding Address.—Annual Meeting of Members; Election of Office-bearers.

LECTURES.

Feb. 8.—J. CLIFTON WARD, Esq., F.G.S., Assoc. R.S.M.—The old Glaciers of Cumberland and Westmorland.

Feb. 22.—WAYNMAN DIXON, Esq., C.E.—Engineer in Egypt for the transport of the Obelisk—Cleopatra's Needle: Its History and Transport.

Mch. 8.—Rev. JOHN SPAVEN, F.R.M.S.—The Telephone; with practical demonstrations.

Mch. 22.—ARCHIBALD HAMILTON, Esq., M.D.—The History of Chloroform and other Anæsthetics.

Apl. 5.—Rev. HARDWICKE D. RAWNSLEY, B.A.—The Brothers of the Poet Laureate.

The Committee of the Ambleside and District Literary and Scientific Society, have much pleasuse in reporting that the establishment and proceedings of the Society have been attended with great success.

A preliminary meeting was held on January 17th, when J. Clifton Ward, Esq., gave an account of the work done and methods employed by the Keswick Society, after which thirty-nine members were enrolled.

The number of members is now 172.

The programme was successfully carried out, both ordinary meetings and lectures having been well attended.

Annual Report of Association Secretary.

The following Report of the work carried on by the Association during the past year will, it is hoped, go far to justify its existence and general methods of working.

Three new Societies have been formed during the year, and have become affiliated to the Association. On Nov. 19th, 1877, the Longtown Literary and Scientific Society was founded, now numbering 42 members; on Dec. 18th, 1877, the Carlisle Scientific Society and Naturalist Field Club, now numbering 159 members; and the Ambleside and District Literary and Scientific Society was instituted upon the 17th of Jan., 1878, and already includes 172 members. Thus the Association now consists of eight different Societies, as follow, named in the order of their birth:—Whitehaven, Keswick, Cockermouth, Workington, Maryport, Longtown, Carlisle, and Ambleside. There are also forty-one Association members, living in different parts of the county, but belonging to no special Society. The total number of members belonging to the Association is about 1100, as against 700 this time last year.

In the carrying out of the winter's courses of lectures and meetings, co-operation among the existing Societies has largely prevailed, and every assistance has been rendered in the formation of new Societies and the strengthening of weak ones.

The Public Lecturer, Dr. Taylor, appears to have given great satisfaction to the six Societies before whom he lectured on Natural History subjects, and a wish has been expressed by many that he might again visit our Association in the same capacity.

The total cost of the Public Lecturer to each Society was only £2 17*s.* 11*d.*, a sum of £6 6*s.* having been voted towards the general expense, out of the Association funds. It may be mentioned that Dr. Taylor afterwards expressed the very great pleasure he had experienced in giving his lecture course to so many attentive Cumbrian audiences.

At the commencement of the winter sessions, Part II. of the *Transactions* was issued. Before the work was commenced, estimates were procured from several local publishers, through advertisement in local papers—and that furnished by Messrs. G. and T. Coward of Carlisle, accepted. The Assoc. Secretary would here wish to acknowledge the prompt attention and helpful care bestowed on the work by Messrs. Coward, and the Association generally will acknowledge that the execution has been equalled by the moderate cost. The estimate for 800 copies of 150 pages, sewed, was between £25 and £26, but the Part ran to 210 pages, the extra quantity being charged for at the rate of 44*s.* per 16 pages. The Part was issued at the low price of 1*s.*, and contains, besides the President's Address and Reports of Societies, nine original Papers and two Abstracts. As an encouragement to authors of original papers, fifty copies of their respective memoirs were sent to each author at a moderate charge.

Each Society has taken a certain number of copies of *Transactions* for its own members, and two of the Societies (Keswick and Maryport,) have presented a copy to each member free of charge.

The following is the Balance Sheet for the past year of the Association. It includes the printing expenses of the Annual Meeting at Keswick, last year, and those of the present meeting, so that the balance now presented is less by the amount of the latter than it would ordinarily have been. It has been thought well, however, to have all clear a-head; and the Secretary and Treasurer to-day to be appointed, will have no incoming expenses to provide for on entering office, but a good sum in hand.*

* There will be expenses in connection with the Lectures given at the Cockermouth Annual Meeting, yet to be deducted from the balance.

Treasurer's Account for the Year ending April 20, 1878.

Receipts.

Balance from last Year	£6	12	3
Capitation Grant, 6d. per head on 1055 Society Members	26	7	6
Subscriptions of Association Members (5s.)— 12 of 1st and 2nd year } 30 of 3rd year (1878) }	10	10	0
Copies of Part II. Transactions sold—			
460 copies to Societies at 1s.			
20 ,, Assoc. Members at 1s.			
40 ,, Society Members at 1s.			
12 ,, Public at 2s. 6d., with commission (£1 3s. 0d.)	29	12	0
60 ,, split up into Author's Papers (£2 9s. 0d.)			
592			
Copies of Part I. Transactions sold— 10 copies to Members at 1s.	0	10	0
Donation on behalf of publication of Lecture on Coleridge—by Mrs. Stanger	3	5	0
Two Tickets to Annual Meeting sold	0	10	0
	£77	1	9

Payments.

Printing Transactions, 800 copies, 210 pages ...	£36	11	6
Illustrating Transactions	2	2	0
Cost of "Authors' Copies" of Papers	1	3	0
Annual Meeting Expenses at Keswick, Printing, &c.	3	13	4
Council Meetings at Workington	1	0	0
Circulars, Stationery, &c.	3	19	6
Grant towards Public Lecturer	6	6	0
Postage	3	0	0
Printing of Circulars, Tickets, and Posters for Annual Meeting at Cockermouth	3	13	6
Balance in favour of Association	15	12	11
	£77	1	9

TRANSACTIONS—800 copies.

583 Copies sold.
51 ,, presented.
166 ,, in hand.

800

Audited and found correct,

J. FISHER CROSTHWAITE.
W. WILLIAMS.

Ere closing my Report, I trust I may be allowed, as both Secretary and Treasurer, to make a few remarks upon past and future work, which I hope may be taken up in the discussion that should ensue on the reading of the various Society Reports.

Undoubtedly our object is mainly this—to draw out the mental powers by specially encouraging self-culture. This may be done by leading members to work out a subject for themselves, and, if possible, present the result to the Society; and by bringing before the members new and varied matter from a circle outside them. In other words, mental growth is the aim; to be brought about by nourishment from within and nourishment from without. The most effectual way of securing this among our Societies is, in my opinion, the plan first pursued at Keswick, and afterwards followed at Maryport, Longtown, Carlisle, and Ambleside,—of having two classes of meetings during the winter session: the Ordinary Meeting, at which Papers are read by Members of the Society only, and the Public Lecture given usually by an outsider, and open to the general public on a small charge. I can speak confidently of the good result, for by the adoption of this plan each Society is bound to provide a certain number of Papers out of its own resources, while the Public Lecturer from a distance may bring in new matter and new life, and the *general* audience which gathers around him serves as a recruiting ground for the enlistment of new Society members. At any rate, I believe facts clearly prove that more papers of an *original character* have been brought before those Societies having these two classes of meeting than before those which have but one class. When the Ordinary Meetings are well sustained by the Society members, the Association Secretary may with all the better conscience help to supply the Lecture course with efficient lecturers from the neighbouring Societies and county at large, for then it becomes a clear case of helping those who try to help themselves.

Another and most essential point in the welfare of a Society is the possession of an efficient Secretary. In many cases I would advocate the union of the posts of Secretary and Treasurer, as an economy of labour and a *concentration of interest* in the work. If,

moreover, as is the case now in three of our Societies, the Local Secretary could also be one of the Delegates, much trouble would be saved to the Association Secretary.

Looking forward to the work of another Association year, I believe there is every prospect of a still further increase in the number of Local Societies; and I doubt not but that the increased number of Association members now scattered throughout Cumberland and parts of the adjacent counties, will help to originate new centres of Society life, and quicken those now in existence. All may and should help forward this work, and whenever any of us see suitable ground wherein to sow good seed, the same should be scattered, and the Association Secretary appealed to for implements and methods to till the new ground and make it fruitful.

With regard to the publication of *Transactions*, I feel that the most trying period has now passed. The first year, much hardship was felt by the decision of the Council—that each Society should take a full number of copies. Yet this course of action enabled the funds to be put on a proper footing at the outset. During the past year, although the general work done by the funds of the Association has been greater; though the 2nd Part of the *Transactions* has contained much more matter than the 1st Part; and though each Society only took such a number of copies as was voted for in each Committee, yet the balance in hand is over £15. This shows that while the general work of the Association—such as the contributing towards Public Lecturers, &c.—may be still more extended during the coming year, there will yet be ample means for the publication of a third Part of the *Transactions;* and several important and original papers have already been recommended to the Council for publication.

Proceedings at the Annual Meeting at Cockermouth,

Upon Easter Monday & Tuesday, April 22 & 23, 1878.

PRESIDENT : ISAAC FLETCHER, Esq., M.P., F.R.S.

MONDAY, April 22nd.

4-15 p.m. Address by the President, at the Public Hall.

5-15 p.m. Paper on "Cockermouth Castle," by Wm. Jackson, Esq., F.S.A., in the Stone Room of the Castle.

6-30 p.m. Public Tea (in Public Hall.)

8-0 p.m. Lecture on "The Probable Condition of the Interior of the Earth," by Sir George Airy, K.C.B., F.R.S., Astronomer Royal, at the Public Hall.

TUESDAY, April, 23rd.

10-0 a.m. General Meeting in the Public Hall.—Election of Officers and next year's place of Meeting. Reading of Reports from all the affiliated Societies, and Discussion upon Society work in general.

11-15 a.m. Reading of Original Papers, (Public Hall :—

"Local Names," by Mr. Peter Harrison.

"Quartz, as it occurs in the Lake District ; its Structure and History," by Mr. J. Clifton Ward, F.G.S.

Experiments with the Telephone.

1-30 p.m. Public Luncheon at the Globe Hotel.

3- 0 p.m. Excursion to the Clints (Limestone rocks) and Isel Hall.

6-30 p.m. Public Tea (in Public Hall).

8- 0 p.m. Lecture on "Wordsworth," by the Rev. Professor Wm. Knight, (St. Andrews') ; in the Public Hall.

ADDRESS BY THE PRESIDENT.

ISAAC FLETCHER, M.P., F.R.S.

When I reflect how ably the chair of this Association has been filled on two former occasions by the Lord Bishop, I cannot but express my regret that his mantle has not fallen on a more worthy successor; but the responsibility rests not upon me, but upon those who have elected me President for the current year. I have received a touching letter from your late President, expressing his warm and unabated interest in the Association and its doings, and also his great regret that on the one hand, the duties of his important office at this season of the year, and on the other, the overwhelming sorrow which has so recently overtaken him, render it impossible for him to carry out his intention of being present on this occasion. Every member of the Association will unite with me in an expression of sympathy and condolence with the good Bishop and his family, in the sudden removal from their midst of one so young, so amiable, and so full of promise.

Although perhaps I am not in a condition to speak with perfect impartiality, I cannot but think that the Association has done a wise thing in selecting Cockermouth for holding one of its early gatherings. The main object of the Association I take to be to diffuse a love for literature and science throughout the district we represent; and Cockermouth and its neighbourhood are honourably associated with both literature and science. Cockermouth was the birthplace of Wordsworth;—of Wordsworth I will say nothing, but simply congratulate you on the fact that the immortal bard will form the subject of a lecture to-morrow evening by Professor Knight, who possesses every qualification for such a task. An audience like this need not be reminded that the neighbouring

village of Eaglesfield was the birthplace of Dalton,—perhaps the greatest of chemists, and a true philosopher in every sense of the word. The late Professor Sedgwick said of Dalton, "from the hour of his birth the God of nature laid His hand upon him and ordained him to the ministration of high philosophy." With such associations as these our good old town may well be proud, and they justify my statement, if justification were needed, that to-night we meet in an appropriate place. To-morrow, literature will be most appropriately represented by Professor Knight; this evening, I rejoice to say, science will be represented by its acknowledged chief, the Astronomer-Royal.

Fortunately for me, and fortunately for you, the presence of these distinguished men renders it unnecessary for me to attempt to do much more than to endeavour to discharge the formal duties cast upon me by the office of President. But as something may reasonably be expected from me even under these circumstances, I propose to direct your attention for a short time to the labours and achievements of another Cumberland worthy who rendered services to science and to the welfare of the human race of a very high order. I allude to GEORGE GRAHAM, who was born in the Parish of Kirklinton in the year 1673.

When the late Dr. Lonsdale was engaged in writing his interesting series of volumes on the *Worthies of Cumberland*, I drew his attention to the important part which George Graham played in the scientific progress of the age in which he lived, and pointed out that whilst he had written the lives of many Cumbrians of lesser note, he had omitted all mention of the most distinguished man of science that Cumberland ever produced, with the single exception of Dalton. Versatile and laborious as were the Doctor's researches, his reading had not been directed very much to mechanics and astronomy, and therefore he had heard but little of George Graham, and he was not at that time even aware that he was a Cumberland man. The life of Graham occupies a prominent place in the last volume of the Cumberland Worthies, which appeared shortly before the Doctor's death. When he had the volume in hand, his health had become much impaired, and at

his earnest request I collected and arranged for him nearly all the facts and substance of the memoir. I mention this circumstance lest any of you who have read Dr. Lonsdale's biography of Graham may think I am merely poaching on his preserves. It has occurred to me that a short account of Graham and what he accomplished might be acceptable to the Society, and be thought worthy of a permanent record in its *Transactions*.

GEORGE GRAHAM, as I have already said, was born in the year 1673, in the Parish of Kirklinton; but of his boyish days we know next to nothing. He went to London at the age of fifteen, and there is no evidence that he ever afterwards visited his native county or maintained any communication with those he left behind him. Probably his early lot was a hard one. His parents were in very humble circumstances, and the general condition of the peasantry at that time was that of grinding poverty and extreme hardship. A petition presented to parliament about the date I have mentioned, says that "families of the first quality had scarcely bread sufficient for their consumption, and no beverage but water; that many died in the highways for want of sustenance, and that there were thirty thousand families who had neither seed, nor bread corn, nor money to buy any." Probably young Graham's reminiscences of his boyhood would be unpleasantly tinged with the memory of much privation, and this may account for his apparent forgetfulness of his native county. In 1688, Graham was bound apprentice for seven years to Henry Aske, clock-maker, London; and at the termination of his apprenticeship in 1695, he was admitted by the Society of Clock-makers, a "free clock-maker." He then became assistant to Mr. Tompion, an horologist of European fame, and an original thinker and inventor of no mean order. So highly was he esteemed, that on his death in 1713, his remains were buried within the hallowed walls of Westminster Abbey.

Before proceeding to an account of the inventions with which Graham will be for ever associated, let me draw your attention to the importance of an accurate measure of Time; for an accurate knowledge of this element lies at the very root of every funda-

mental astronomical observation; and to take the most practical and utilitarian view of the subject, yet one which transcends almost every other in importance—it is upon an exact means of finding the true time and keeping it when you have got it, that the safety of our ships and the lives of our seamen mainly depend. For these reasons eminent horologists and astronomical instrument makers have always ranked with eminent astronomers, and most justly so; and what I now wish to impress upon you is this,—that the most eminent horologist England ever produced was a Cumberland man, and that man was George Graham of Kirklinton.

When Graham's apprenticeship expired, he at once entered into Mr. Tompion's service, and became his chief assistant and most intimate friend. On the death of Tompion, Graham inherited the business and reputation of his master, both of which he largely extended, and indeed, speedily eclipsed all rivals. His whole time was devoted to the perfecting of the art of horology, and the constructing of instruments for the most delicate astronomical researches. It would be quite out of place at a meeting of this character for me to enter into the minutiæ of Graham's mechanical improvements in clocks and watches; they may be found in Denison's "Hand-book of Clock-making," and in all rudimentary treatises on the subject. His capital improvement in watches was the invention of the horizontal escapement; but it was in the clock that he mainly distinguished himself.

At the period in question, probably the best clock in existence was no better than an ordinary kitchen clock of the present day: good enough for domestic and business matters, but unfit for any scientific purpose. Graham made two improvements, the importance of which can hardly be over-estimated. The one was the "dead beat escapement," and the other the "mercurial compensating pendulum." The joint application of these two inventions, combined with the exquisite finish and workmanship which characterised his handicraft, at once converted the clock from a useful domestic machine into a scientific instrument of the highest value; and, in conjunction with the transit instrument, it has, since Graham's inventions were applied to it, been adopted

to the exclusion of all other methods, to the determination of the right ascensions of the stars, on the accuracy of which all the fundamental problems of astronomy are based, and on which the art of navigation is mainly dependent. I therefore claim for Graham that he was not a mere dreamy speculative philosopher, but that he applied his talents with unwearied assiduity and perseverance to the practical purposes of life, and to the promotion of the welfare and happiness of mankind.

Probably there are none of you who have not observed that in old-fashioned kitchen clocks which are furnished with a seconds hand, the hand *recoils* at each beat of the pendulum. Though somewhat of a technical matter, I will here give Dr. Pearson's description of the distinction between the old "recoil escapement" and Graham's "dead beat escapement," remarking in passing that Dr. Pearson was himself a Cumberland man of considerable reputation.

"The recoil escapement, and which is most commonly applied to ordinary clocks, impels and retards by turns, the alternate motion of the pallets by its continued action on their faces, occasioned by a force derived through the media of the wheels and pinions from a suspended weight denominated the maintaining power; while the crutch on the axis of the pallets, transmits this modified force to the rod of the pendulum, and thus perpetuates the vibrations. The constancy of the escapement-wheels' action with the pallets in this construction, owing to their cuneiform shape, is so circumstanced that the force of the returning pendulum makes each pallet in its turn oppose the force derived from the maintaining power, when the wheel is obliged to recede for a moment, and the seconds hand inserted on its axis at the same time *recoils*. The effect of such action is the alternate pushing and opposing of the pendulum in different parts of each vibration, that an increase in the maintaining power accelerates the rate of going; and consequently, any irregularity in the action of the wheel work, which deals the force out in small portions, or any foulness from dirt or thickened oil, will have an undue influence on the rate by varying

the arc of vibration, and accordingly this escapement is never adopted in an astronomical clock.

"To avoid the bad effects of a recoil, the justly celebrated Graham invented that species of escapement which is called 'dead beat,' in which the faces of the pallets are circular as well as concentric, and allow the teeth of the escapement wheel to rest on them, while the pendulum is completing its vibration, after receiving its impulse; this wheel, therefore, never recedes, and the hand carried by it remains motionless, or dead, for a certain portion of each vibration. The rubbing of the teeth against the circular portion of the pallet, however, produces some friction, that requires a little fine oil to lubricate the parts of action, and an addition given to the maintaining power by increasing this friction retards the rate of going. Hence the wheel work is usually made with the greatest care, and pinions of not fewer than eight or ten leaves each, are nicely fitted, hardened, and polished, to diminish the irregularities of transmitted force; the pivot holes also of the two wheels' last arbors, as well as the pallets themselves, are frequently jewelled in the best clocks, to avoid friction as much as possible, and to supersede the necessity of applying much oil. Escapements of this description have long been held in high estimation when they have had the advantage of being united with a well-compensated pendulum. Indeed, till within these few years, no other escapement was put in competition with it, and the observations made in the different public observatories for half a century back bear testimony to its competency. The circumstance of its giving the impulse to the pendulum at or near the lowest point of its arc when its momentum is a maximum, affords a most important advantage."

This was written more than fifty years ago, and Graham's "dead beat" still holds its own, though it has been improved upon by the escapements of the Astronomer-Royal, Hardy, and others. In a private letter to me, Sir Edmund Beckett, the well known parliamentary counsel, and a great authority in horology, says, "Graham's dead escapement has been used for more than a century in nearly every astronomical clock in the world, and

without it, it is not too much to say that there would have been no better time-keeping than could be obtained from a common kitchen clock made more carefully than usual; at least, until some of the latter inventions of Hardy and others, which might have been more generally adopted if Graham's had not existed."

The other capital invention of Graham was the "mercurial compensating pendulum," to which I have already alluded. Its principle is very easily understood. Galileo's attention is said to have been attracted by the swinging to and fro of some lamps suspended from the roof of a cathedral, and he observed the fact that the same lamp performed its oscillations in the same time whatever might be the arc of vibration. Further investigation revealed another law, viz.—that different lamps swing in times proportioned to the square roots of the lengths of the cords by which they were suspended. The subsequent study of these laws gradually led to the application of the pendulum as a means of regulating the rate of a clock; and it is probable that for this purpose it will never be replaced by anything more efficacious. The length of a pendulum vibrating seconds in the latitude of London is 39·6 inches; and if it were possible to make a pendulum on which variations of temperature had no effect, it would be theoretically perfect, and would be (certain other conditions being complied with,) an accurate method of measuring out time. But there is no substance in nature which is insensible to changes of heat and cold, and therefore it was found that the rate of a clock varied with changes of temperature. In hot weather the seconds pendulum lengthened, and the clock lost time; in cold weather it shortened, and the clock gained. The problem which Graham set himself to solve was this: to construct a pendulum which should practically be insensible to changes of temperature; and this he effectually accomplished by a contrivance wonderfully simple and beautiful. Lindley Murray tells us that "two negatives in English destroy one another." Applying this principle to Mechanics, he rightly concluded that two expansions in opposite directions would likewise destroy each other, with the result that, virtually there would be no expansion at all. Fortunately, he

has left behind him in the Philosophical Transactions a detailed account of the various experiments which resulted in the invention of the "mercurial compensating pendulum," which consisted of a rod of steel of the requisite length, but instead of having a leaden bob at the end, he adopted a glass cylinder, containing a given quantity of quicksilver, a metal singularly sensitive to changes of temperature.

The effect of such a combination is at once apparent. If the temperature increases, the rod lengthens downwards, but the column of mercury lengthens upwards, and the centre of gravity remains unaltered. On the other hand, if the temperature falls, the rod shortens upwards, but the column of mercury shortens downwards, and again the centre of gravity remains unaltered.

As I have before remarked, the combination of these two inventions of Graham, at once raised the clock from the position of a useful article of furniture, to that of a scientific instrument of the highest value; and so thorough was the quality of his workmanship, that there is to this day in the Greenwich Observatory a clock by Graham in daily use, which must be about 140 years old, the performance of which, even yet, is on a par with that of any other in the establishment.

But it is not as a means of regulating a clock with accuracy only that the pendulum has rendered great services to science; it has been used with wonderful success, by watching its oscillations in different latitudes, to determine the exact figure of the earth, and more recently, by the Astronomer-Royal, for the no less important purpose of weighing the earth, by watching its oscillations on the surface, and at the bottom of a deep coal shaft at Harton Colliery, in the county of Durham, with a result probably more accurate than those arrived at by other methods.

Graham also was the first watch-maker of his day, and no dandy of the period considered his personal adornment complete unless he possessed one of his repeaters. In 1753, the "London Magazine" contains a poetic effusion, which describes the ingredients required in the manufacture of a fop:—

"A repeater by Graham which the hour reveals,
Almost over-balanced with knick-knacks and seals."

It was not in horology only that Graham was pre-eminent, but as a maker of astronomical instruments, especially of those where accurate graduation is essential, he had no rival in his day. Mr. Sheepshanks in the "Penny Cyclopædia," says :—"The art of dividing assumed a new form under the celebrated Graham, the father of all good clock, watch, and instrument making in this country, and the worthy associate of Bradley." He constructed a large iron quadrant for the Greenwich Observatory, which remained in constant use until the year 1811, when it was superseded by a six foot mural circle made by Troughton, who, singularly enough, was also a Cumberland man, and, like Graham, the foremost instrument maker of his day. It is still carefully preserved, and Sir George Airy informs me that in 1829, when he made a tour among the European Observatories, he was struck with seeing how many quadrants were still retained as instruments of the highest class, which were copies of the Greenwich quadrant. He also made an instrument called a Zenith Sector, which, in the hands of Bradley, who became Astronomer-Royal on the death of Halley in 1742, led to the two memorable discoveries of the aberration of light, and the nutation of the earth's axis. But not only did he devise and make the instruments with which these discoveries were made, he was largely engaged with Bradley in making the actual observations which resulted in those discoveries. It is worthy of remark that these observations were undertaken for the purpose of endeavouring to find the parallax of the fixed stars ; but the results which flowed from them were hardly less important. In short, it is not too much to say that Graham himself, besides furnishing the instrumental means, contributed largely by his personal labours as an observer, to the store of facts which led to the discoveries with which Bradley's name will be for ever associated. Bradley himself says, in a communication to the Royal Society :—"A mind intent upon the pursuit of any kind of knowledge, will always be agreeably entertained with what can supply the most proper means of attaining it. Such to the practical astronomer are exact and well contrived

instruments; and I reflect with pleasure on the opportunities I have enjoyed of cultivating an acquaintance and friendship with the person that, of all others, has most contributed to their improvement. For I am sensible that if my own endeavours have in any respect been to the advantage of astronomy, it has principally been owing to the advice and assistance given me by our worthy member Mr. George Graham, whose great skill and judgment in mechanics, joined with a complete and practical knowledge of the uses of astronomical instruments, enable him to contrive and execute them in the most perfect manner. The gentlemen of the Royal Academy of Sciences, to whom we are so highly obliged for their exact admeasurement of the quantity of a degree under the arctic circle, have already given the world very convincing proofs of his care and abilities in those respects; and the particular delineation which they have lately published of the several parts of the Sector which he made for them, hath now rendered it needless for me to enter into any minute description of mine at Wanstead, both being constructed upon the same principles, and differing in their component parts chiefly on account of the different purposes for which they were intended."

It is worthy of remark that this same Zenith Sector was used at the Cape of Good Hope between the years 1838 and 1848, for observations connected with the measurement of an arc of the meridian, and is now preserved at Greenwich.

Graham also gave much attention to the subject of Magnetism; he discovered the diurnal variation of the compass, and made many observations with the dipping needle, throwing much light on this obscure but interesting subject. He also investigated with acuteness and labour, the standards of weights and measures in the Exchequer, and others which were kept for public purposes; but it is not needful to allude to them further than to show the range and importance of his researches.

In connection with his business as a watch-maker, some characteristic anecdotes have come down to us. It is related that on the occasion of a person applying to him on the subject of a watch upon which his name had fraudulently appeared, he at once

broke it with a hammer, and presented another to the person, saying, "Sir, here is a watch of my making." He would never allow an inferior article to pass out of his workshop, and worked far more for fame than profit. He often lent money, but never would take any interest; and all his savings were locked up in an iron box.

At the request of the Earl of Macclesfield, Graham's portrait was painted by Hudson, and afterwards engraved. A contemplation of this likeness led Dr. Lonsdale to the following reflections:—"Judging from it, Graham appears to have been a man of considerable stature. His physiognomy offers strongly marked features, and of a northern type that is by no means rare in the Border district. His wig interferes with a just appreciation of his cranial capacity, but there is enough visible of his frontal developement to indicate the man of clear discernment, shrewd intellect, and power. His visage is long; his eyebrows large, but not overshadowing; clear observant eyes; his nose is prominently marked; whilst his lips and chin show a less masculine type than the rest of his facial features. There can be little hesitation in inferring from the study of his portraiture, that he was endowed with thoughtfulness, acumen, and fixedness of purpose. Along with his self-possession there seems to breathe an air of *complaisance* and kindly feeling; but the most tangible manifestation in his portrayal is strength of mind, with large perception and general knowingness of character. A collarless coat buttoned up in the front, with full skirts and ample outside pockets, upturned sleeves giving freedom to the wrist, and the opportunity of displaying white linen; breeches buckled at the knees, and strong hosing covering the lower limbs, constitute his habilaments. He is seated on a big arm chair; upon his knees rests a three-cocked hat holding his gloves, and portion of his right hand, whilst his left arm rests on a table near to a book. A portion of a clock, with a glass front showing the mercurial pendulum, graces the wall of the apartment,—a fitting, or rather an historical adjunct to his portraiture."

He was never married, and no record of his domestic life or social habits has come down to us. He died full of years and full

of honours at his house in Fleet Street on Saturday, the 16th of November, 1751, in the 78th year of his age. On Sunday night, the 24th, his remains were buried in the nave of Westminster Abbey, in the same grave where thirty-eight years before his friend and companion, Thomas Tompion, was interred.

The "Gentleman's Magazine," vol. xxi., contains an obituary notice of him, the sonorous phraseology of which raises a suspicion that it may have been written by Dr. Johnson:—"As he was perfectly sincere, he was without suspicion; as he was above envy, he was candid; and as he had a relish for true pleasure, he was generous. He frequently lent money, but could never be prevailed upon to take any interest; and for that reason he never placed out any money on Government Securities. He had bank notes which were thirty years old by him when he died; and his whole property, except his stock-in-trade, was found in a strong box, which, though it was less than would have been heaped up by avarice, was yet more than would have remained to prodigality."

A slab is placed over the grave of Tompion and Graham, bearing the following inscription:—

Here lies the Body
Of Mr. THO. TOMPION,
who departed this
life on the 20th of
November 1713, in the
75th year of his age.

GEORGE GRAHAM, of London,
watchmaker and F.R.S.,
whose curious inventions
do honour to ye British Genius,
whose accurate performances
are ye standard of mechanic skill.
He died ye XVI. of November, MDCCLI.
in the LXXVIII. year of his age.

To the best of my knowledge George Graham is the only Cumbrian whose ashes rest beneath the vaulted roof of Westminster Abbey, where for many ages have been deposited England's most illustrious dead: her Kings and Queens, her Statesmen and Warriors, her Philanthropists, her Philosophers, and her Poets.

Such was the brilliant career of the poor peasant boy of Kirklinton.

It is very remarkable that nearly all our most eminent makers of instruments intended for refined astronomical observations, were north country men; for in addition to Graham, Troughton, the ablest artist of his day, was born in the parish of Corney, in this county, in the year 1753. Then there was the Rev. William Pearson, who, though not a practical mechanic, devoted his life to the thorough investigation of the principles and theory of astronomical instruments, and the methods of using them, and published the result of his labours in two large quarto volumes which form the most elaborate and comprehensive work on Practical Astronomy that ever issued from the press. John Bird was a Durham weaver. He was employed by Graham, and afterwards began business on his own account. His attention is said to have been first drawn to the subject of the accurate graduation of instruments by observing the imperfect division of a clock dial. Jessie Ramsden, a man of equal celebrity, was the son of a Yorkshire innkeeper. Lastly, the present Astronomer-Royal, who unites with his many accomplishments a profound knowledge of Mechanics, and who has effected an entire revolution in the principle of astronomical instrument making, is a Northumberland man. I content myself with drawing your attention to these curious facts, for I confess I have no theory to advance.

Turning for a few minutes to our Cumberland Association, I may fairly congratulate you on having already attained a fair measure of success. A glance through the two volumes of *Transactions* in print shows the variety and value of the subjects which have claimed the attention of the members, and they contain many original papers of much interest. Without being invidious, I may point to the biographies of Fletcher Christian and Jonathan Otley

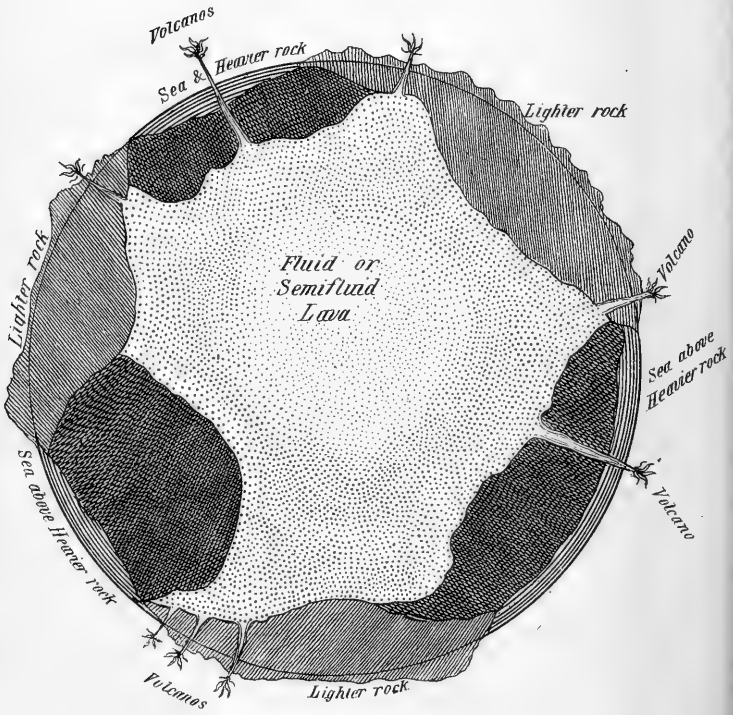
as being admirable productions of more than local interest; and the other papers are all good in their way. Dr. Dodgson's elaborate paper on the Meteorology of Cockermouth, leads me to a subject on which I wish to speak with all caution and moderation. The Lake District has recently been shaken to its centre by a project of the Manchester Corporation to supply Manchester and its neighbourhood with water from Thirlmere, and there is no doubt the scheme will be carried into effect. I am not going to bring a hornets' nest about my ears by raising any controversial question; I shall take no æsthetic view, nor dilate on the iniquity of reversing a natural water-shed. But in a merely engineering point of view the scheme is a grand one, and by way of encouragement to those of you who are engaged in original observations of any kind, I would point out that it is to the investigations of a very few private individuals into the rain-fall of the Lake District, who proved an average fall among the mountains ranging from 80 to 180 inches, that the feasibility of the project on which the Manchester people are about to expend something like £4,000,000 sterling, mainly depends. This shows in a striking manner that results almost national in their importance may, and do continually, flow from the steady and anxious inquiries of those who search into facts, and into the laws of nature, with no other object than to arrive at the TRUTH.

It has been suggested to me in connection with Professor Knight's promised lecture on Wordsworth, that beyond a painted window in All Saints' Church, the birth-place of the Lake Poet has no monument to perpetuate his fame. It may indeed be said of him, what can be said with equal truth of every great man, that his works form the best and more durable monument; still, I think the suggestion is worthy of your consideration—that at Cockermouth something more should be done in honour of Wordsworth's memory.

It only remains for me to congratulate you on the results which have hitherto attended the Association, and to express a hope that your labours will bear good fruit in the future. I will hazard the prediction that, at any rate, the Cockermouth meeting will prove a success.

BRITISH MUSEUM

Reduced Copy of the Diagram of IDEAL EARTH referred to in the text.



ON THE PROBABLE CONDITION OF THE INTERIOR OF THE EARTH.

(WITH A PLATE.)

A Lecture delivered at the Annual Meeting, Cockermouth, April 22nd, 1878.

By Sir GEORGE AIRY, K.C.B., F.R.S., Astronomer-Royal.

Some time ago your Secretary, Mr. Ward, suggested to me that an address might be given by me in this Hall on the subject of the Probable Condition of the Interior of the Earth. I was not able at that time to attend to his suggestion, but at a later time, when your President kindly called upon me to appear before you, I adopted the suggestion of Mr. Ward in the selection of that subject. And in doing this, which I do upon my own responsbility, I wish to remark that the nature of the subject is different from any on which I ever lectured before,—in regard to its indefiniteness, to the doubts on some parts, to the difficulties all through;—and if I considered it to be my absolute duty to lead you to a definite point, I should have found some difficulty in doing so. But I can give you somewhat as explaining my ideas of probability, and I can advert to points that will be found interesting and valuable. I propose to take my address in three parts. The first will relate to measures generally of the earth; the second will relate generally to observations of temperature; and the third will relate to the manner in which we may suppose the earth to have been formed, especially with reference to the nebular hypothesis; and after that I shall give you my general notions upon the conclusions to which they all lead.

Now in regard to measures. I must begin with some ideas upon the way in which extensive measures are made upon the surface of the earth. I daresay there are gentlemen present who are so well accustomed to the ordinary process of surveying that they will enter into the matter at once; but it appears proper to explain to my audience the way of proceeding. In the first place a line of a few miles in length, commonly six or eight miles, is measured with the utmost care—with a degree of care of which you have no conception—with bars brought into contact in the most definite way, in which intervals are measured in the most exact manner, with corrections for temperature, and many other things into which I cannot enter at present. Surveyors will easily comprehend that if a theodolite is placed at each end of this base-line, and if an object on a hill is observed at a distance, there is no difficulty in ascertaining the distance of that new point on the hill from either of the ends of the base. Then advantage of that determination is taken to go to another hill, and then to two or three more hills; and hill after hill is observed in that way till by these processes a whole country is covered by triangulation. It is possible to lay down a map of a large district in which the distance between any one point and any other point is certain perhaps within a few inches. I have here two specimens of this triangulation. I am sorry that the nature of the address does not admit of exhibiting them in a manner in which they can be seen by a large audience like this, but as I propose to stay here at the conclusion as long as it may appear advantageous, I shall be glad if gentlemen taking interest in the matter will come upon the platform and look at these. This (pointing to a map) is one of them. This is the triangulation over the greater part of Europe, as it existed a few years ago. Then (pointing to a second map) there is another. This is the triangulation of the great survey of India, which is one of the most remarkable triangulations in the world. I hope those who have followed me in the principle of triangulation will inspect these two; they are authentic documents, and you will learn something from them. That is the first process in the way of measuring upon the earth. Now arises the question—how is this to be made available

for ascertaining the dimensions and the figure of the earth? For this purpose we must go to astronomy. One thing which must be fully understood by you is this, that when we speak of observing a star, we are observing something so prodigiously distant that the direction in which we look at it may be taken as absolutely the same from whatever part of the earth we view it. The nearest star of which we have any accurate notion of distance is distant more than two billions of miles. I have here a map of a portion of the earth with its proper curvature, and I am sorry since I made it that I did not give it an improper curvature and make it more convex, as it would have been more intelligible. It contains the British Islands, and it shows the degree of curvature the earth has in that extent. This (showing an apparatus upon the table, a rude imitation of a Zenith Sector,) is a very rough affair. It represents an astronomical zenith sector, or an instrument for measuring the apparent distances of stars from the point over-head. Starting at the Isle of Wight, I direct that telescope to a certain star there. Suppose now that I carry the same instrument to a place in Shetland, and I look at the same star. In consequence of this curvature of the earth's surface, my telescope points too high, and I must give it a certain degree of inclination in order to catch the same star. That change of inclination in passing from the Isle of Wight to Shetland is not because the place of the star is moved, but because the direction of the footing of the instrument has changed. It does not stand on the same level here as it did there, and that degree of tilt which I have been obliged to give to the telescope in order that, having seen the star from that place with the telescope in one position, I may see the star from another place—that degree of tilt is the genuine degree of change in the position of the ground. That gives me a measure of the curvature of the earth. So that, by these two processes, one of triangulation —measuring enormous distances with great accuracy; and the other—by observing the same star with the same instrument at different places, and so getting a distinct difference in the curvature of the earth,—by these we can compute the diameter of the earth supposing it to be a sphere. This is the manner in which all the

great measures have been made; and I am able to exhibit to you upon this globe—for the use of which I am indebted to a Society similar to your own in East Suffolk—the principal lines that have been measured in the north and south directions. There are astronomical advantages in taking these measures in the north and south rather than in any other direction. I only mention that as accounting for the directions of certain lines, and those lines I have laid down by pieces of paper upon the globe.

Now, beginning from the East. The first is the Great Indian arc, which extends from Cape Comorin to the neighbourhood of the Himalaya mountains. The second is the greatest of all: it is the Great European arc, which, by the united efforts of the Germans, the Russians, and the Swedes, has been extended from the Danube to the North Cape. It is a prodigious arc. In calling your attention to this map of the triangulation of Europe, I am desirous of pointing out to you one line in particular. When you come to look clearly at this map, you will see that over the greater part of Europe the triangles are numerous, partly for the purpose of territorial survey, and partly for purposes like this—for the dimensions of the earth. But beyond St. Petersburg you see a single chain of triangles, through the desolate parts of Norway to the North Cape. It is a truly scientific and meritorious enterprise, undertaken not for any territorial purpose, but solely for the measure of the earth. It begins as a single chain at St. Petersburg, and so goes on to the North Cape—a line of great extent.

To make a recapitulation of the principal arcs measured. I begin with that of India. Then there is this very long one, through the East of Europe. The next is the French Arc, begun during the height of the terrors of the French Revolution; and it is a most remarkable instance that that noble nation would, at the most agitated time, turn their attention to Science. It starts from a small island not far from Minorca, and extends to Dunkirk. Observe that, as it was done before the others, its methods are not quite so good as they are now. Then here is our English Arc, which extends from Dunnose, in the Isle of Wight, to the northernmost point of Shetland; that is an arc of the highest

quality in regard to its exactitude. The next in longitude is one at the Cape of Good Hope, done in the first instance by French astronomers of the last century, but extended by the last English astronomer who was at the Cape of Good Hope. Then there is one in Peru, of no great value now, and comparatively a short one. Still I am unwilling to let it go without notice, for this reason. When the question of the figure of the earth was raised theoretically by Sir Isaac Newton, it was disputed; till, of all people in the world, the French took it up, and determined to make a critical observation. They sent out two expeditions of great celebrity, one was to Lapland, and the other went to Peru actually to cross the Equator, and it was a noble combination of enterprise. I should have been unwilling to leave this out of sight at present, although it is not so valuable by any means as these others. These are the principal measures that we have, and upon these depend our estimation of the size of our globe and its shape. When we look at them, they seem hardly sufficient. I should like to see a dozen twice as long, and I have no doubt some of our successors will have an arc measured along the whole of South America, and another along the whole of North America. However, that is not done yet. Taking these as the best materials which we have at present, we find from their agreement that there is no doubt that the earth is very nearly a sphere. In fact, they agree so well—and with another correction, which I shall indicate in a few moments—that they leave no doubt at all in our minds that the earth is essentially a sphere. Everything goes upon that, and everything answers properly. Of course it is a method of measuring the earth, founded, in the first instance, upon few measures, but if our theory were wrong it would soon be found out. But every calculation and every comparison of the theory with observation, has agreed in confirming the notion that, generally speaking, the earth is a sphere. Now to apply this to a numerical measure of the dimensions of the sphere. I mentioned to you that by the use of the zenith sector with its telescope for observation of the stars, we can obtain the curvatures of the earth's surface. Suppose in going from this place in the Isle of Wight

to that in Shetland, the ground is tilted say ten degrees, and the distance is nearly seven hundred miles. If it is ten degrees for seven hundred miles, we have only by a rule of proportion to find out what the length would be for three hundred and sixty degrees. That is one in thirty-six, and you have only to multiply seven hundred by thirty six and you have the entire circumference of the earth. That is the way the dimensions of the earth are ascertained. Thus we come to the general conclusion that the earth is a sphere eight thousand miles in diameter, and twenty-five thousand miles in circumference.

When I speak of the surface of the earth, it must be understood that we always mean the surface of the earth as referred to the sea level,—to that level which, if the land were perforated with canals, the sea would take there. Above it stand mountains, and below it the depths of the sea. When you see a mountain, you think it is a great thing, and that it should be taken into consideration. Mountains are taken into consideration by persons going accurately into the depths of science,—but they are very small in proportion to the earth. Suppose we had a model of the earth twenty-five feet in diameter, how much do you think the mountains on such a sphere would rise above the level? One-fifth of an inch. That would never be seen. It may be neglected entirely. The greatest depression of the sea would be about one-fifth of an inch also. Understanding that, we may say generally, that as far as our accurate measures go, our earth is a sphere; to which I shall refer again, introducing a small modification of considerable importance.

Then, having got so far, there is another thing which is important to our principal subject, and that is the density of the matter of which the earth is formed. This is a subject which has engaged the best experimentalists in a variety of ways. The first of these experiments is a very celebrated one, known as the Schiehallien experiment, so called as being made on the attraction of the mountain Schiehallien, in Perthshire, in the Scotch Highlands. It ranges to the east and west, and is well adapted to the measures of attraction, carried on in the north and south directions.

We will consider what the effect of a mountain will be. I have got this instrument, to which I have referred, and it is in a position here to observe a star. Suppose all on a sudden you were to introduce a mountain here. Now, the effect of that upon the instrument would be this. The position of this instrument must be determined—that is to say, the position of its fundamental bearing must be determined—by a plumb-line or a level, which is pulled down by the earth's attraction. If the mountain were not there, the only force upon the plumb-line would be downwards. But if you had a mountain here, the force would be a combination of two, one pulling down and the other towards the mountain, so that upon the whole, the plumb-line by which this instrument is regulated does not take the same direction as when there is no mountain. In like manner, if the instrument is carried to the other side of the mountain, the plumb-line, instead of being drawn down, is drawn in an inclined direction, being attracted by the mountain. Therefore, we have a disturbance of the plumb-line produced by the circumstance of the mountain being here, which disturbance can be determined by observations of a star made on the opposite sides of the mountain. The real difference in the slope of the earth's surface on the opposite sides is to be compared with what the difference would have been between the two situations supposing the mountain had never existed. The observation is one of great accuracy. At Schiehallien the difference was eleven or twelve seconds,—I do not recollect the exact quantity, but there was no doubt at all as to its reality and its amount. Having got that, there is this proposition to be considered. If the mountain Schiehallien, whose dimensions we can measure, pulls a plumb-line aside so far, what is the proportion of its attracting mass to the attracting mass of the earth? This may be a little obscure to persons who have not made any observations such as are familiar to surveyors. As you see, the two stations of the instruments are so far apart that the position of their plumb-lines ought to have differed we will say by sixty seconds. But it is found with this mountain between them, that the positions of the plumb-lines differ seventy-two seconds, or perhaps more. The comparison of

these gives us the effect of the attraction of that mountain, as compared with the attraction of the earth. There is a mountain at a certain distance, and this great earth at another certain distance: by due computation from that, with the attractions above-mentioned, we find the proportion of the mass of matter in that mountain to the mass of matter in the whole earth. Then as we also know the magnitude of the mountain and the magnitude of the earth, we can compare the density of the mountain with the density of the earth. This was gone through with extreme care, and the density of the earth was ascertained to be four-and-a-half times the density of water; the earth therefore is more dense towards the centre than at the outside.

The next experiment that was made was almost free from objection. It is what is known as the Cavendish experiment. It was a cabinet experiment entirely. Here is a rod with two light balls upon it, suspended by a fine wire, which is the most delicate suspender we have. Then two huge masses of lead were placed one on one side of one ball, and one on the other side of the other ball, and they tended to pull the rod round by attracting the small balls. Then the experiment was varied by placing the masses of lead each on the opposite side of its small ball; and in that manner the circumstances were changed so as to show how much the great balls of lead attracted these little balls. By a series of calculations, of which I cannot pretend to give you a precise idea, the density of the earth was ascertained, and that gave a greater result than before, namely—that the average density of the earth was about five-and-a-half times that of water.

The third experiment was one I made myself in the Harton Colliery, near South Shields. It was judging how much the force of gravity was altered by going to a great depth, that force of gravity at the top and bottom being ascertained by swinging a pendulum. At a depth of twelve hundred feet the pendulum swung two seconds more in a day. That gave the average density of the earth as a little more than six times that of water. Every experiment is open to some objection; but I believe the best calculation is the one founded upon the Cavendish experiment,

and I am ready to take five-and-a-half times as the average density of the earth, including every part of it. The consequences which flow from that are rather striking. Of course, as this density is much more than double that of the surface, it shows that it is more dense towards the centre than the outside. One result of the calculation rather startled me when I made it. Since the constituent parts of the earth press upon one another as you go down, what is the pressure per square inch when you approach the centre of the earth? There are many gentlemen among you who have heard of a pressure of fifty or a hundred or two hundred or three hundred pounds on the square inch. I believe the greatest we know is ten thousand pounds on a square inch of tough Aberdeen granite, which is just sufficient to crush the granite. My calculation of the pressure at the centre of the earth gave thirty millions of pounds on every square inch. It is an astounding thing, and we cannot conceive what consequences may follow on that. The word million runs very easily off the tongue, but if you attempt to construct it you find it a very unmanageable thing. If you make a hundred dots on a page, and do the same over ten thousand pages, you will find it will take a long time to make those dots; and if you repeat it thirty times, you will find it an enormous labour for which life will hardly suffice. But to conceive that as the pressure of things at the earth's centre—we don't know such a thing; we don't know the consequences. Perhaps gas may be squeezed into gold, or silver into platinum; a solid may be forced into powder, or powder into a solid. We are in total ignorance; and that is one of the troubles of this case.

Now I come to a result of another kind, namely, that of the rotation of the earth. The earth revolves once in the course of a day. Everybody knows also, from the housemaid who spins a mop to the highest philosopher, that the rotation would swell out the middle of the earth. Calculations have been made on that, and the result is that the diameter of the earth in the equatorial direction is greater by about one three-hundreth part than the diameter in the polar direction. I cannot attempt to represent

this to you on a diagram. If I had made a diagram twenty-five feet in diameter, it would only have amounted to half-an-inch on each side. You must accept that as a thing which has been very accurately calculated from theory; and the way in which it has been determined from observation is this. If the earth is swollen out at the equator, then the earth is flatter towards the poles than it is at the equator: the bend of the earth is more rapid at the equator than at the poles. We have great materials for arriving at a certain conclusion on that point. That was the first thing in the remarkable French experiment I mentioned, that is,—the relation of the bend at Peru to that at Lapland. There have been many similar results, but the best is that found by combining the great European arc that goes so far north, and the Indian arc that goes so near the equator. Generally speaking we have all agreed, and there is no doubt that it is a general fact that the different parts of the earth have those different degrees of bend.

Now when in this manner, by the measurements of arcs, we obtain the measures of the dimensions of the ellipsis of the earth, and they agree so well with what we calculated on the supposition that the mass of the earth is or has been fluid, it leads us at once to the conclusion that the earth has been in a fluid state. Taking the dimensions of the earth as measured upon the sea, there is very little departure from those computed on the elliptic supposition. There are mountains in some places, but a great extent of sea in others, and islands are cropping up in all places; and altogether the form is not such as would be taken by piling a number of blocks for building any structure, but the form that would be taken by a fluid mass carrying floating solids, and partially solidified since the form was taken. But it has at some time been in a fluid state.

There is a curious thing which was brought particularly under my notice some time ago during the Indian Survey. The Indian arc begins at Cape Comorin, and goes through the whole length of India past Delhi. It is a most remarkable arc in geographical position. The officers used the instruments for the star-observations at divers points on the line. They found these

observations went on in perfect harmony with the understood conditions of the earth, till they came to the neighbourhood of the Himalaya range. It was not unnatural to conceive that the Himalaya mountains would exercise an influence on their levels; and they did so, attracting the plumb line from the direction it would otherwise have taken towards the centre of the earth. The magnitude of this attraction was measured with much care, and then the theoretical calculation was taken up by Archdeacon Pratt. (When Mr. Pratt was a young man I examined him at Cambridge, and I was then struck by the practical tendency of his knowledge of mathematics.) He examined carefully the measurements of the mountains, and what their disturbance of the plumb-line ought to have been. To his great astonishment he found it ought to have been a great deal more than it really was. It seemed there was something that almost neutralised the attraction of the Himalaya mountains. With the ideas I have on the circumstances, I have no difficulty in suggesting the cause. In the sectional diagram I have here, suppose the black part to represent the mountains, and suppose this lower part to represent lava—as we will call it for want of a better name—and suppose the lava to be much more dense than the mountains, and that the mountains are floating upon that lava. Now, when you see a thing floating upon water or anything else, you are quite sure that that which stands highest above sinks deepest below. If you see a great log of Memel timber, and a small spar or English pole, and the great log rises highest above the water, you are sure that it also goes deeper. So does a great ship go deeper than a boat. Supposing that to be the representation of things here, this follows,—that a great deal of this light matter has displaced a great deal of the heavy lava matter, and the attraction of the upper part is neutralised in great measure by the circumstance that the heavy lava is displaced. That very curious observation seems to reconcile the whole. So far I have said all I have to say respecting the measures.

The second part of my lecture is founded on what we know about the temperatures. I must mention in the first instance that we know something of the rate at which temperature travels through

the earth. We know it in this way:—The experiments, as with many good experiments, began with the French, who fixed thermometers with very long stalks, to the great depth of twenty-five feet into the ground. This was followed up after some time by similar thermometers at the Observatory at Edinburgh, and about the same time at Greenwich, and there the deeper thermometers are read every day. The first and most conspicuous result of this, is the discovery of the retardation of the seasons. High midsummer at a depth of twenty-five feet occurs in December. It has taken five months for the heat at the surface to travel down twenty-five feet. That is very slow travelling. If you compute it further, it takes a hundred years to travel a mile. If the crust of the earth is one hundred miles thick above any of the hot matter which may be supposed to be below it, it must take ten thousand years for the transmission of heat through it, and so on in proportion to the thickness of the crust. This shows that really after all we may have a great deal of heat below us, and it will not come to us for a very long time. It will come at last, but it will be travelling slowly; and in the meantime we have the radiation from the earth, so that it is conceivable, with the cool comfortable earth we have here, there may be a great heat below. In every part, I believe, of the earth, there is the evidence of intense heat at former times. The extent of volcanic action is very much disguised on the earth by the effects of air and water, which have degraded the surface in almost every part. The body which is most nearly similar to the earth in some former state, in several respects, is the moon. But the moon has no air and no water. The surface of the moon, in almost every part, is volcanic; and that would in a former state have been seen on the earth in general; but in the earth the action of the air and water have degraded the rocks, and many traces of their original form are lost. But if we look at the old rocks of the earth, we find there has been volcanic heat in some shape or other in almost every way. In the limestone rocks, for instance, there are the basaltic beds, which in some places go by the name of "toadstone;" they are certainly the result of volcanic heat which has produced

fluidity. In some rocks in Cornwall, and almost everywhere, we find there are volcanic streams intermixing with all the harder strata which originally existed. Although the surface of the earth has been free from volcanoes in a given district for a time, yet there has always been volcanic action near enough to force in veins of fluid lava from time to time. It seems, therefore, that we are entitled to say that we have always been near a great degree of heat. We have been nearer than we are at the present time; but we are still near enough to experience a great deal in these countries. Experiments have been made on the increase of temperature as you go downwards, and the increase is one degree of Fahrenheit sometimes in sixty, and sometimes one hundred feet in depth. There is some uncertainty about it, but the increase of heat is considerable. There is one mine in Cornwall I have been in, in which I have walked in a stream of water actually scalding to the legs. We know the quantity of water in various hot springs, and there is a great display of volcanic action which certainly came from great heat somewhere; and in the intermediate ages we can trace the formation of basaltic continents at no very distant period. Since the valleys assumed their present shape in the centre of France, they have been choked up with basaltic matter, which you can trace to the volcanoes from which it came. In the former ages there has been much more heat than at present. In later times there is a great deal shown in the ejection of fluid volcanic matter among volcanoes.

There is another thing in connection with that, of which I speak with no great boldness, but yet to which I cannot deny some importance—that is the change in magnetism. The subject of terrestrial magnetism is one of the most obscure in the world; nevertheless I think, looking at the direction in which it always acts towards the colder parts, and tracing its general phenomena, it must be affected by thermal electricity; and I imagine that this may be produced by the constant wear going on in some parts of the interior of the earth, where the hot fluid lavas are wearing away solid parts, or are consolidating themselves into solid parts—

I cannot tell which—but there is a constant change which may cause the change in thermal magnetism which is such a puzzle.

Within a few years, the voyage of the *Challenger* has been made, and I have little hesitation in saying it is one of the most important made in the scientific history of the world. In crossing those great seas, they have sounded to greater depths than ever before; and have measured, in a satisfactory way, the temperature of water down to the bottom, to a depth of five miles. At those depths the water is cold. There is great controversy about this, whether the cold here can be formed by a stream of cold water coming from the polar regions. I believe that stream has some influence, but I do not believe it has enough. At the bottom of the water, the ground on which the water is lying at those great depths, is cold. I do not think that part partakes of the same heat as other parts; that I express as my opinion, in which, of course, I should be met by the disbelief of a great many persons, and I do not argue it any further than that. That is the state of things as far as we know regarding the present temperature of the earth; but there is evidence everywhere that there has been enormous heat almost all over the earth. I will not say whether there has or has not been the same heat in those which I consider the cold masses, but they are so near heat that they are perforated in places that come near volcanic heat; and there are volcanic islands in all parts of the oceans. There is evidence, therefore, that there is heat very near the surface. In one of the bays of Italy, not a great way from Naples, I have thrust my hand through the sea into the sand, and found it so hot that I was glad to take my hand out again. That difference of the apparent temperatures at different parts, I look upon as a theory leading us to the conclusion of what the earth really is. I think I have said enough of the temperatures.

Now to enter upon a matter which is undoubtedly one of the boldest speculations of modern science, and the conception of a very vigorous intellect. It is the formation of the Earth. I cannot say its creation, but its formation,—the way in which it has

been put into its present shape. The theory of which I have to speak, known as the nebular hypothesis, is one of the conceptions of Laplace. It was remarked by Laplace that every planet revolves in the same direction round the sun; and they all turn on their axes in the same direction. It was difficult to deny that there must be some general cause for this, and it naturally occurred to Laplace that if we could find something which was contracting its dimensions, and which had a little rotation to begin with, then, with every contraction of dimensions, that little rotation would become more and more rapid, till it might acquire any degree of rapidity depending on the condensation of the parts not condensed before. We look out into the world. Can we find anything in such a state that it is probably being condensed, and, having some trifling rotation, will come at last to a rotation that will whirl parts off and form a system of planets and satellites? There is a system of bodies in the skies which did not attract much attention in former days, mainly because telescopes were not large enough; but they are attracting attention now-a-days, and are being catalogued by thousands. They are nebulæ. When you examine the sky, small clouds of white matter are to be found. These are small bodies in the skies among the stars. Sometimes they have stars apparently among them. Sometimes they seem to be connected with stars, and sometimes not. They have the strangest and most capricious shapes imaginable. One of the great nebulæ is in Orion. That (pointing to a drawing of the nebula) is a very strange piece of matter to form a solar system from, yet there is no doubt, mathematically speaking, that it is competent to that purpose;—that if this nebula is attracting its particles together, so as to come to a more condensed state, and if it has a very slight rotation to begin with, that rotation in the course of condensation will become so rapid, that it may form sun and earth and planets round it; and there is no difficulty whatever, on contemplating the matter in this supposition, of making a complete solar system out of such a mess as that is. I think that is the most conspicuous to all our telescopes, and also perhaps one of the most confused and complicated. There are

others which have acquired names for themselves, such as the Horse-Shoe and the Dumb-Bell; another is that in Andromeda, and there is the ring-nebula in Lyra, very well known (represented in diagram).

In the observations that have been made lately with the best and largest telescopes, in the first instance of Lassell and Lord Rosse, both of which are reflecting telescopes of the largest class, there has come to light a system of nebulæ called spiral nebulæ (one is represented in this drawing). They seem to have some bearing on the supposition that the nebulæ are contracting and getting into a rotatory state. But these changes go on so slowly that whether human life is long enough to see them we do not know. We have not been able to infer with certainty any of the changes of which I speak; the whole thing is theoretical, but is in the highest degree probable. Supposing things contracted together in this way, they would get rapid rotation, and in their contraction they would become very hot. Condensation of them would produce enormous heat, and we have there sufficient explanation of the great heat we find in the centre of the earth, or little below the surface of the earth in some places.

Now there is another circumstance connected not simply with the nebulæ but with other stars. We suppose, of course, that the stars have been formed from the condensation of nebulæ. A series of scientific inferences, founded upon optical observations, has come to light in late years, which has done more to reveal some of the secrets of nature than anything before,—that is spectroscopy. It is a word not generally understood by many of my audience, and I cannot explain it, on this occasion, so fully as I could wish. Sir Isaac Newton first made extensive use of a prism of glass. Whether he invented the prism or not I cannot say, but he was the first person who made a rational use of it. In looking through a prism at anything, say at a lamp, you will see into what strange colours its appearance is changed. We know that on looking at a brilliant white lamp we see it partly red, and blue, and green. We know it is not a change of the light, because

we can put the colours all together and their union is white again. We are able to separate it as distinct lights and possessing distinct properties. By voltaic action, sparks like those of the electrical machine may be produced which derive their characteristics in great measure from the metal from which they spring; and the characters of those metals give different characteristics to the sparks. We have one set of these produced by iron, another by nickel, and others by hydrogen gas, and so on. These have been observed and catalogued with great care. When we observe the light of the stars in like manner, we find there are scarcely two stars alike. Some are found exhibiting that light which is given in sparks from iron, and others shewing the light derived from a number of different things, and we are actually able by legitimate reasoning to say what the stars are made of. As a general rule there are hardly two stars alike, so that in this nebular hypothesis we are not bound to say that the nebulæ are all of the same materials; and we may go further in this assertion when we come to consider other matters, and say that even the parts of any one nebula are not of the same materials; and we are justified in saying so, by comparing things that we know of the bodies of the solar system. We cannot see anything different in the light from them, because they all get their light from one source, that of the sun. But it is in regard to what we know of the densities that we are justified in saying that their compositions are different. As I have said, the average density of the earth is probably five-and-a-half times that of water. But the density of the sun is only once that of water. The density of Mercury is nearly the same as that of the earth; the density of Venus and Mars is much the same. Then comes a shower of little planets numbering about two hundred, and we cannot tell what these are made of. Jupiter and Saturn are no heavier than water. Therefore assuming the formation of these things by condensation of nebulæ, on the theory I have mentioned, it appears clear that the different parts of nebulæ which have contributed to form our solar system are very different. That being considered as established, it follows as likely enough that in the constitution of our earth there are parts of very different

density. If one might presume on such a point, I should say that the high parts of the earth are made of something light. The heavy dense parts are those covered by considerable quantities of water, and they have sunk deep into the centre of lava, in which I conceive all things to be resting.

I come now nearly to the end of my theory, and I will show you what you will think is an absurd representation of what I consider the earth to be. Here is a diagram of the earth. See Plate. You will remember that everything here is exaggerated; it is not intended to be a correct representation. It is a caricature, and a caricature of the most extravagant kind; but if it conveys to you the broad ideas which have impressed themselves on my mind, it will be doing the right thing. It will only be expressing what I really think about the broad characteristics. I do think that a large proportion of the central part of the earth is fluid and hot, and I think that upon this there are resting divers classes of something like solid matter,—how many I cannot say, but it is enough for my purpose to take two. The deep black I take to be heavy rock; and the fainter black is lighter and floats lightly; and all the rest of blue-green colour is sea. There are at various places cracks or chinks where volcanoes break out. At some places where the crust of the earth is thin you can have two or three volcanoes close together, as in Europe we have Etna, Stromboli, and Vesuvius. So that, in this figure, absurd as it may seem, I have condensed, to the best of my conjectural power, my supposition as to what the state of the earth really is; and if anybody chooses to find fault with it, I will not quarrel. I give it as a sort of inference from the number of things I have said. My lecture is terminated, and I only hope that those of my audience who have not fully caught my words, or have in other ways failed to understand me, will come up and speak to me.

(This Lecture was taken down by short-hand reporters and subsequently revised by the lecturer.)

LOCAL NAMES.

By PETER HARRISON, (Keswick.)

(Abstract.)

One advantage, and that perhaps not the least in value, arising from the cultivation of the intellectual and reasoning faculties, is the habit of observation and reflection which the strivings after knowledge engender and call into action, and the daily, nay hourly, pleasure afforded by the exercise of such a habit. Let any one, for instance, who for years, it may be, has been in the habit of walking abroad without any other purpose in view than the exercise of his limbs and the inhaling of the fresh air of field and fell, be led by any chance to have his interest awakened in the commonest objects around him. If after frequenting some grove or wood, let us say, for years without paying any special attention to the various kinds of trees, he be once led to distinguish one class from another and to inform himself of their various rates of growth, the respective uses and values of their timber, the most suitable soils and situations for their growth, their size and productiveness, and—better still—if of those of foreign introduction he learns to refer each class to its native climate, and to know something of the causes or reasons which led to their introduction. How much fresh food for thought will have here been supplied him! With what additional pleasure will his future rambles be attended! Or let us suppose that all his life he has had a strong love for the mountains, that he has visited their summits and explored their valleys over and over again; that with their varied outlines, their contours, their huge bulky masses, their ravines, precipices, waterfalls, and passes he is familiar; that he has admired

their exquisite loveliness when viewed from a distance through the soft light of a summer's eve, and felt the influence of their lonely grandeur and majesty when witnessing from their summits a sunrise in the early morning. Let him have had experience of all this, and yet be ignorant of the causes which for ages have been at work to produce so much loveliness and grandeur and majesty. By some slight incident, it is probable, at first his attention is drawn to some object he had never thought much about before—some rock, or even stone by the wayside—his interest is aroused, he looks around him and about him; begins to observe, compare, and classify, by putting his observations side by side with one another, and drawing his own inferences. He has found a key which opens to him the gateway into a new field of knowledge. He extends his observations; he avails himself of the knowledge stored up in books upon the subject—the result of other men's experiences who have gone before him over the same field, or whose greater opportunities and abilities are far in advance of his own,—he comes step by step to know more of the geological structure of a district he has traversed so oft. He learns to distinguish the igneous from the aqueous rocks, and finds that these not only determine the nature of the soil he is treading on, but also the character of the indigenous flora around him. In one region ice-scratchings, terminal moraines, and transported boulders, tell him of a far-off time when vast glaciers were slowly scooping out, or giving their present form to, our more upland valleys. In another direction he finds the ground strewn with scoriæ, ash and lava, pointing back to a still more distant time when the internal fires of the globe were giving rise to the material of some of our finest mural precipices. Or while wandering over the beds of slate on our mountain slopes, his attention may be arrested by observing embedded in the stones beneath his feet the encrusted forms of plants and animals which carry him back in thought almost to the dawn of life in its lowliest forms upon our globe. Is it not likely that a new kind of interest will be added to his walks abroad? that every now and then some new light will be flashing in upon his mind to yield him fresh delight? that objects he had

long been familiar with, henceforth to him will possess a new meaning?

As it is with the world of objects surrounding us, when we walk abroad among the works of Nature, so is it when we turn to books which treasure up for us such inexhaustible sources of refined pleasure, from which we can refresh the over-taxed mind or body. In the region of romance we may be able to enjoy the descriptive powers of Scott, and laugh at the humour or weep at the pathos of Dickens. In the field of poetry and imagination we may be able to appreciate the stately sublimity of "Paradise Lost" and the loftiness of its theme, or be lost in amaze at the far-seeing philosophy of human life of a Shakespeare. We may be able to admire and appreciate the language which clothes the thoughts and aspirations of the greatest and noblest who have ever lived, and yet all the time be insensible to the worlds of poetry, of history, piety—nay, even of superstitious bigotry, religious persecution and crime, which are oftimes hidden in the words themselves, entirely apart from the subject matter of the writer. Even from words of commonest use we may often draw interesting scraps of information. For instance, I am reading now from a "book." In its primary signification the word *book* does not mean an article made up of paper, print, page and binding—it once meant nothing more than "beech," i. e. the tree we know as the beech; and probably the term at first meant "bark"; and this carries us back in thought to the remote ages when our ancestors, still dwelling in the forests of Germany, used the smooth bark of that particular kind of tree on which to *scratch* or *write* their Runes long before they knew the use of the alphabet. I have just made use of the word "write." It comes from a Teutonic root, "Ritzen," or "Reitzen," which signifies *scratching* or *tearing*, and bears testimony in itself to the usage common among the northern nations of employing some hard substance, such as wood or bark, on which to scratch or grave their legends, or record the warlike exploits of their heroes. Again, there is the word "read"; the word comes to us through the Anglo-Saxon noun "roed," "rad," or "red," which meant speech, counsel, advice. It has a whole host of kindred in the

modern languages of Teutonic origin, and is not without representatives in the Irish, Welsh, Latin, and Greek tongues. In the Moeso-Gothic, "rodyan" meant, *to speak*, and was in use long before the old northern tribes had any books to *read*, in the modern sense of the term. That it retained its original signification long after books came into use, may be seen in such phrases as "Read me this riddle"; or in Shakespeare, when speaking of a noble woman, he exclaims in a fine spirit—

> "Those about her
> From her shall *read* the perfect ways of honour."

The same root was used very happily by the Anglo-Saxons in the formation of personal names, some of which still exist. There is the exceedingly appropriate feminine "Mildred," or Mild, i. e. *gentle* in speech, and the masculine "Eldred," or *old in counsel*, and so on. Then we might take another monosyllable, "spell." We might show by reference to our early literature, that it had not formerly that sense to which it is now almost wholly restricted, of naming the different letters of which a word is composed. In Anglo-Saxon literature the phrase "Ealdra Cwena *Spell*" is found, which, literally rendered, is "Old Wives' Fables," showing that the saying is nearly a thousand years old. Their *spell-boc* was a book of Homilies or of History, and we see in the compound "God-spell," softened into Gospel, that the root *spell* signified a story, narration, a tidings. One more instance still of a monosyllable, though of a different class. The word "green," like most of our monosyllables, comes down to us through the Anglo-Saxon, but is probably of much earlier origin than the Anglo-Saxon language. Now, how many of us have used the word all our lives without having ever given a passing thought to the full force of its meaning? We know that it is used to distinguish one color from another colour; we use it as such, and think no more about it; but our conception of its meaning is enlarged when we come to recognise it as a form of the verb to "grow." "Green" is that which is "growing;" and probably we here gain some little insight into the origin and rise of new terms,

or of the new application of words already existing. From the earliest times of human speech, there must doubtless have been terms whereby to express the idea of the upspringing and growth of vegetation, which the revival of the year brings with it to gladden our hearts; and hence, when men had distinguished this from other colours, and wished to give expression to the distinction, they likened it to "growing" things. If, then, round such words of common everyday use, and, to unobservant readers, at least, of such ordinary significations, we can group information that is interesting, and sometimes, too, instructive; much more can we do so with those more significant expressions, names of places, or to speak technically, local names. Among the Bahama Islands there is one bearing the name of "San Salvador." It is a small piece of land of coral formation, and of little commercial importance; yet, nevertheless, noteworthy for all time as the first land sighted in the New World by Columbus in that voyage of discovery, which has perhaps done more than any other event recorded in history to affect the condition of mankind. It would be foreign to my purpose to enter into the story of Columbus, or to follow him in his voyages. . . . All this has been admirably told by Washington Irving. We can well imagine the deep thankfulness of the man, when after seventy days of buffeting with the waves and storms of a wide and unknown ocean, and the still greater perils he had escaped from at the hands of a mutinous crew, he at length set foot upon a new shore. One of his first acts, we learn, was to erect the symbol of the Christian faith, and kneel before it in deep thankfulness for the great mercies bestowed upon him; and then rising, he proclaimed that the land should hereafter bear the name of San Salvador, i.e. the Holy Saviour. Doubtless he called to mind that other voyager of ancient days, who submitting himself to the Divine will, and committing himself to the same protection, in token of his thankfulness for the preservation of himself and family, "builded an altar to the Lord" on Mount Ararat. It was not until five years after this event that Continental America was discovered. John Cabot, a Venetian merchant settled at Bristol, was sent out by Henry VII. of England. He reached that part of

the mainland now known as Labrador. This name owed its origin to motives far different from that of San Salvador, having been some years after its discovery bestowed upon it by the Portuguese slave merchants on account of the strength and endurance of the hardy "labourers" whom they kidnapped on its coasts. Of that powerful federation now known as the United States of America, the smallest in point of size is the State of Rhode Island. Its capital, "Providence," is the second in size and importance of all the cities in the New England States. The name furnishes a curious commentary upon the spirit in which religious toleration was viewed two hundred years ago by men who had themselves become voluntary exiles for conscience' sake, for daring to proclaim the great principle that the "doctrine of persecution for cause of conscience is most evidently and lamentably contrary to the doctrine of Jesus Christ," and that "no man should be bound to worship against his own consent." Roger Williams, a minister of the gospel, was banished from Massachusetts, and compelled to seek refuge upon an island at that time unsettled by the white man. The site of the city marks the spot where his canoe first touched the shore; and, when in scanning the map of America, we come across the name of "Providence," let us think of its founder, Roger Williams, to whom justly belongs the honour of having established the first political community in which perfect religious toleration was admitted. The mere enumeration of the hundreds of names inscribed upon the map of the New World, to which interest of a varied kind is attached would, I fear, be a tax upon both your time and patience this morning. . . . The name "Virginia" as surely points out that a Queen was ruling the destinies of England when that State was founded; as the name "Queensland" will point out to generations yet to come that a Queen was again holding sway at the time that colony was carved out from the Australian Continent. Such names as *James*town, James River, Cape Charles, the Carolinas, the Rapid An, Georgia, and a hundred others, possess no small interest for the student of the history of the colonization of America. Similarly, the share taken by other European nations in the exploration and settlement of the

Americas, can be traced with tolerable accuracy, by means of the names inscribed upon the map. In the Spanish Main, and all along the shores of the Gulf of Mexico, Spanish names will be found to predominate. . . . Santa Cruz, and Vera Cruz severally mark the spot where the Spaniards erected the Holy Cross and the True Cross, preparatory to the Conquest of Mexico, and eventually to that of Peru. Would that more of the true Spirit of Him, of whom the Cross is the symbol, had animated their breasts, rather than that insatiable thirst for gold which left a trail of cruelty and violence and blood upon their track, happily unparalleled even in the annals of conquest. There would have been one foul stain the fewer inscribed in the pages of the so-called civilization of the age. For more than two thousand miles along the Brazilian coast, the map is studded with names of Portuguese origin; while on the opposite, or Pacific coast, Spanish names again preponderate. Some commemorate the Saint Days on which the particular places were discovered, as Santiago or St. James, &c.; others are of the descriptive class, as Valparaiso, i.e. the Vale of Paradise; several are corruptions of the aboriginal names, and a few are of English origin. In short, the names laid down upon a modern map of the new world, may be compared to a kind of irregular mosaic work, pregnant with interest to those who can spell out the history of each separate piece. First there is a pavement of primitive setting represented by aboriginal names. Some of these are descriptive of the great natural features of the country, such as mountains, rivers, lakes, &c.; others are derived from the names of the tribes who once owned the soil, but have now wholly disappeared; a third class are commemorative of some remarkable events in the history of those tribes. . . . Around the whole coast, and occasionally intruding inland, along the courses of rivers, there is a secondary setting, consisting of names imposed by the early discoverers, conquerors, and settlers. These names are derived from the language of every maritime nation in Europe; each has a history of its own, too. The tertiary is composed of names bestowed in recent times, and serve to mark the progress made by the white man in settling the wide domain of prairie and forest,

over which once roamed countless herds of buffalo and the race of the red-skin. This formation, it is needless to say, is still going on, though one could wish that a people speaking our own tongue, and sprung from our own stock, had made choicer selections in naming new settlements than they have done in many instances: Smithvilles, Jonesvilles, and Brownsvilles are numerous. Most of the States have their Thebes, Cairo, Athens, Troy, Rome, &c. Russel, in his diary of North and South, describes one of the "Corinths" as "consisting of a wooden grog-shop and three log-shanties;" while he found the Acropolis represented by a "grocery store;" and all that can be seen of the City of Troy is "a timber house, three log-huts, a saw-mill, and twenty negroes."

It was my intention to touch upon the place-names of that still newer world, which is so fast rising into importance at our Antipodes, by a process similar to that which has been done with the map of the Americas. Similar results could have been obtained, but time at present forbids; besides, those who feel sufficiently interested in the matter, can work out the subject for themselves by reading the Voyages of the Early Navigators—Tasman, Dampier, Cook, Carteret, &c., aided by a good modern Gazetteer and Maps.

The investigation of the earliest European place-names is beset by considerable difficulties; in some instances the languages from which they are derived have passed away; in others they have become so much corrupted as to make the attempt to explain them satisfactorily little better than guess-work. Still, a great deal has been done in recent times to unravel their significance, especially by the German philologists who are now being closely followed by some of our English scholars. In order to follow such authorities, some knowledge of the present state of philological science will be necessary. . . . I will condense into as small a space as possible the leading principles of Philology which bear upon Nomenclature. It has been shown beyond dispute, that the present existing languages of Europe—the Turkish, Basque, Finn, and Lapp excepted—are closely akin to each other. They form, together with the Indianic and Persian, one family, known as the

Indo-European. The same terms, under slightly different forms, all of which are satisfactorily explained by what is known as Grimm's Law, (expressing the idea of the numerals up to ten) exist still in Sanscrit, Greek, Latin, Welsh, Old Sclavonic, modern Russian, French, Spanish, Italian, Anglo-Saxon, German, Dutch, Danish, Gothic, and English. Some of the personal pronouns are common to all. The terms expressing relationship, as father, mother, sister, brother; the names of some parts of the body, as "tooth;" of some of the domesticated animals, as "cat," "mouse," "goose;" of agricultural tools and agricultural operations; and of two or three of the commonest metals and cereals, and various other terms, are identical in most of them. Sanskrit and Pali are the dead languages of India, and bear the same relationship to the modern dialects of Hindostan as the Latin does to the modern languages of Italy, Spain, and France. The Zend is a dead language, and bears a similar relationship to modern Persian. The same may be said of Old Sclavonic and modern Russian, &c.; and what are known as Meso-Gothic and Anglo-Saxon, hold a like relationship to modern German, Dutch, Danish, Norwegian, and English. Philologists refer the whole of these languages to one parent stock, to which they agree to apply the term "Aryan." This Aryan language, they reason, from the internal evidence it furnishes of itself, must have been the speech of a people leading chiefly a pastoral kind of life, generally peaceable in their nature, and subjected to bonds which knit men together in communities. The country inhabited by this ancient race must have been in Asia, probably to the north and north-west of Hindostan. They must have separated, or at least sent off successive tides of emigrants to overspread and occupy other lands, long before the dawn of history: one branch turning southwards, and peopling Hindostan; another moving westward, and peopling Persia; others, by slow degrees undoubtedly, pressing on further west and north-west, until further progress was finally debarred them by the shores of the Mediterranean and the Atlantic. Judging by the oldest European place-names, viz., those of mountain, river, plain, and valley, they seem to have passed over Europe in two main streams,

and at periods of time considerably apart. One stream descended the great river-valleys of North Germany, and, crossing the North Sea, peopled the northern part of Great Britain, the whole of Ireland, and the Isle of Man. The other flowed in a more southerly direction, peopling ancient Greece, Italy, a great part of Spain, France, and the southern part of our own Island. At least this is the testimony afforded to us by the study and comparison of the Indo-European languages, if the study and comparison of languages be of any value in lending aid to the researches of History and Ethnology. Those who spread over the north of Britain, Ireland, and the Isle of Man, are now distinguished from the others by philologists, by the term Gadhelic, or Hiberno-Celtic. Their language still survives in the modern Gaelic of Scotland, the Erse or Irish, and the Manx. The southern Celts are known as the Cymri, or Cambro-Celtic race, and their language is still spoken in Wales, and by nearly three millions of the inhabitants of Brittany in France. The Gaelic, Erse, and Manx have a close relationship, being only, in reality, varying dialects of the same tongue; the same affinity exists between the Welsh and the Breton; but between the two languages themselves, i.e., between the Cymrio and the Gadhelic, the relationship is no closer than that between modern English and German. Now these nations must have overspread Europe in ages long anterior to the historical era. They were a numerous and powerful people in Gaul in Cæsar's time, and when he crossed over to Britain, he found them no less powerful or warlike. They were not altogether unacquainted with agriculture; they had an established religion, with its hierarchy, temples, groves, grove rites, mysteries, and ceremonies. In short, there is nothing to lead us to think they were strangers in the land, but on the contrary, much to lead us to conclude that they had long been in possession of the "Isles of the West." More than two thousand years ago, the then inhabitants of Cornwall supplied the Phenician traders with tin from their mines.

By the time the light of history does break in upon us, we find another wave of people flowing westward and approaching our

shores, viz. those tribes we now include under the generic name of Teutons: they are known to us in history as Angles, Frisians, Jutes, Goths, Danes, and Norsemen. Who were they? Whence came they? History is dumb, or at least such utterances as she has given forth are mere speculations and guess-work. Modern Philology has done much to solve the enigma. A comparison of the Teutonic languages with the Celtic, proves beyond doubt that the Teutonic races were originally of the same stock as the Celtic; that they, like the Celtic, had at one time led a pastoral life; lived in communities; worshipped a Supreme Being, whom they looked upon as the author of all *good*, and had known the family ties which bind men together in domestic affections. The same test, i.e. the test of language, shows at the same time that the two races, the Celts and the Teutons, had been separated by a wide gulf of time, sufficiently wide to allow the two languages to become considerably different from each other. The southern Celts, the Greeks, and Romans, worshipped the Supreme Being under the name of Dios, Zeus, Jupiter (all the same word) i. e. the God of Day. The Persians are sun-worshippers still, and the Druids of Britain taught the worship of the heavenly bodies. The Teutons deified the sun and the moon, as seen in the names Sunday, Monday; but they only knew the Supreme Being as God, i. e. Good. There is a Sanskrit root *hima*, signifying Snow; it is found in the name of the loftiest range of mountains in the world—Himalaya, i. e. the abode of Snow. The southern Celts must have carried this root-word with them, for we find it embodied in the written language of both Greeks and Romans; in the former *cheima*, in the latter *hiems*, both signifying the same thing, viz.—*Winter*, i. e. the *Snowy Season*. To signify the same season of the year, the Teutons had a totally different word. Long exposure to the cold howling blasts that sweep over the plains and forests of northern Europe, led them to characterise the return of that dreary time of the year by the term *Winter*, i. e. the *Windy Season*.

To the earlier comers, the Celts, the names of all the great natural landmarks of the country over which they spread, as one might naturally expect, are due. Among the rivers the Rhine,

Rhone, Danube, Elbe, Weser, Oder, are a few examples. Among mountains, the Alps, Apennines, and Caucasus will suffice. With very few exceptions the river-names of Great Britain, Ireland, and the Isle of Man, are Celtic; the same holds good of the mountains of Scotland and Ireland, and partially so of those of England and the Isle of Man. With respect to the names of the bays, estuaries, headlands, political divisions, towns and villages, the case is somewhat different. As we saw in the case of America, so was it in the British Isles. From time to time our shores were invaded by men of different nations. First the Romans, then the Saxons, now Angles, then Jutes, Danes, Norwegians, and lastly, the Norman—they either slew the people whom they found in possession of the land, or enslaved them, or drove them into their mountain fastnesses. They carved out for themselves new districts, founded new settlements, and gave them names of their own. Thus it is we have to deal with a medley of place-names derived from the languages of the Celt, the Roman, Saxon, Angle, Dane, Norwegian, and Norman. One instance by way of illustration. We know from history that the Danes, after many fierce struggles with their kindred, the Saxons, succeeded in gaining a footing in England. A district on the east coast, extending from the Wash to the Tees, and known as the Danelagh, was assigned to them as a place of settlement. The names of the towns and villages over the whole of that district are, with very few exceptions, of purely Danish type. In Lincolnshire alone there are sixty-three place-names containing the suffix—*thorpe*, which is the Danish for village. . . A second instance. Among the sea-faring nations of yore, there were no more adventurous, more skilful, or more hardy sea-rovers than the Norsemen. In the tenth century Norway sent out a colony to Iceland; Norsemen seized upon and colonised the Shetlands and Orkneys; they sailed up the North Sea, passed through the Straits of Dover, crossed the Bay of Biscay, and entered the Mediterranean. Norse Vikings harried the Hebrides and the east coast of Ireland; they seized the Isle of Man, which they erected into a Norse sovereignty, and sailed along the coast of Wales into the Bristol Channel. Wherever they

came, there they left the imprint of the Norse tongue upon the mountains, the headlands, bays, creeks, and coasts. In Pembrokeshire there is still a cluster of Norse names—Milford, Tenby (Danes village), Fishguard, and a score of others. Off the coast of North Wales, "Ormes' Head" is purely Norse. Of the seventeen parishes into which the Isle of Man is divided, fifteen are distinguished by the term—Kirk; several names of the Manx villages are compounded of a Norse personal name and the suffix —*by*. There are several "dales," "nesses," or headlands, and "wicks" or bays round the coast. The highest mountain in the Island bears a true Norse name, "Snaefell," i. e. Snowfell. Near Ramsey there is a mountain which, according to Train, once bore the name of "Skeafell," i. e. Sky, or Mist Fell; which probably explains the meaning of our Cumberland Scawfell. Among the islands of western Scotland, and on the west coast itself, Norse place-names still abound; they run across the north coast, too,—and very singular it seems, at first sight, to find that the most northern county in Scotland should bear the name of Sutherland, or Southland; but this becomes intelligible enough when we find that the Orkneys once formed a Norwegian jarldom, and when we reflect that to people dwelling to the northward, Scotland would as much be a south land as the north coast of Africa is a southern land to Spain.

Now, these Northmen had a great share in the formation of the present names of places in Cumberland and Westmoreland. Throughout the Lake District proper, these names are almost exclusively either Celtic or Norwegian. The "gills," "haughs," "howes," "thwaites," "forces," "dales," "fells," and "holms," as applied to islands, or rivers, or lakes, are abundant, and they are purely Norse. The suffix—*thwaite*, is found in more than two hundred instances in the two counties; it occurs but once in Northumberland, is altogether unknown in Lincolnshire. The term signifies a *clearing*. *Garth* is a common name in the dales. We have Applegarth, Deergarth, Gas or Goosegarth, Gatesgarth, etc.; its kindred terms are garden, yard, orchard, etc. *Force* is an expressive term for a Waterfall;—the word had lived among the

inhabitants of the district merely as a dialectic term until Wordsworth incorporated it in his writings. It is now an accepted English word, and in the Lake District, at least, has supplanted the use of the Italian exotic, cascade.

An interesting question connected with this concluding part of my subject arises here. How came these Norwegian place-names into the English Lake District? Neither chronicle nor history can give an answer. There is no recorded invasion or irruption of Norwegians into this part of the country. Towards the latter end of the ninth century the Danes marched northwards from the Humber, entered Northumberland, and effected a permanent settlement in that county. These Northumbrian Danes made incursions into Cumberland, destroyed at one time the City of Carlisle, and, if we may be guided by the evidence of village names, colonies of them must have settled in the more open and fertile parts of Cumberland and Westmoreland, for there is a cordon of Danish place-names extending from Appleby northwards along the vale of the Eden to the north of Carlisle, thence across the Cumberland plain to Allonby, and along the belt of coast country as far as Ravenglass in the south again. Of these distinctively Danish names, all terminating in the suffix—*by*, an abode, there are more than sixty in the two counties, but not one, I think, in the region of the Lake District proper. We may fairly infer, then, that the Danes did not settle as colonists in the fell-dales. If Ferguson in his interesting work on the Northmen in Cumberland and Westmorland, has given a satisfactory answer to the question, then one more proof is afforded of the value of the study of languages and place-names as a means of throwing light upon obscure points often met with in the study of history and ethnology. In the absence of all historical evidence he has shown conclusively, I think, by a careful comparison of the language and place-names of the colonists of the Isle of Man, with the dialect and place-names peculiar to the Lake District, that the dales and valleys of the mountainous regions must have been seized upon and colonised by men of Norwegian blood from the Isle of Man. This theory is strengthened by the fact that many of the holdings

of the statesmen of the dales were allodial rather than feudal in their tenure—just such as would be formed by men who in making for themselves new homes in new lands would adopt—

> "The good old rule, the simple plan,
> That they shall take who have the power,
> And they shall keep who can."

QUARTZ, AS IT OCCURS IN THE LAKE DISTRICT; ITS STRUCTURE AND ITS HISTORY.

By J. Clifton Ward, F.G.S., F.R.M.S.

Introduction.

I. Geological Distribution.

Vein Quartz, under four conditions.

Quartz as a Rock Constituent,

(a) Of Stratified Rocks.
(b) Of Unstratified and Volcanic Rocks.
1. Among Granitic and Granitoid Rocks.
2. Among Intrusive Diorites, Dolerites, &c.
3. As an Accidental Constituent.

II. Quartz as a Microscopic Study.

Introduction.

There are few minerals more widely spread than Quartz, a chemical compound of the two elements Silicon and Oxygen. Common though this mineral is, however, its study opens out questions of deep interest, and may lead us from the contemplation of a pretty piece of rock-crystal to the consideration of subtle and hidden processes in the formation of the crust of our globe.

I. GEOLOGICAL DISTRIBUTION.

Quartz occurs among our Lake-country mountains in several forms, but never as a rock by itself, in thick bedded masses, as is occasionally the case in other mountain tracts.

Vein Quartz, under four conditions.

(1) Constituting the whole thickness of a Lode or Vein, in which case the latter may be said to be a Quartz Vein, unless the quartz contains much valuable ore, such as Lead or Copper, for then it will more frequently be called a Lead or Copper Vein with a quartz vein-stone. Some of these Quartz Veins are of considerable width—many yards—and run in straight lines, sometimes for several miles, though often broken by faults. That they contain gold in small quantities is certain, and I have in my possession some small grains of this precious metal extracted from a vein of Quartz in Borrowdale. It is well known that gold has been mined in Wales for a great many centuries, but it seems not to exist in any of our Cumberland Quartz Veins in workable quantities, so far as I have been able to judge.

(2.) Instead of being itself a lode or vein, quartz frequently forms strings or courses running in or through a lode formed of various mineral substances. Supposing the lode be lead-bearing, it often becomes an important question, how much of the vein-stone be quartz, and how much calc-spar, barytes, or other minerals. For the quartz is very much harder than most other constituents of veins, and if the ore has to be extracted entirely from such a matrix, the labour is much increased. Nevertheless, sometimes even a quartz ore vein-stuff is quite crumbling, and when so, the working is comparatively easy. This is the case with several lead-veins occurring in the Vale of Newlands.

(3.) Quartz when occurring either as a massive lode or a slender string is opaque, and generally of a pure white colour; but it occurs, thirdly, in the form of clear transparent crystals, lining the sides of cracks and fissures either in massive quartz or in some other mineral substance. These crystals have the general form of a six-sided prism terminated by a six-sided pyramid; but owing to variations in the relative size of the several faces the appearance of the crystals may vary. Sometimes also they are coloured in various tints, due to oxides of iron, manganese, etc., mingled with the oxide of silicon, or silica, as it is more usually called. It will be

noticed that the pointed ends of the crystals project away from the sides of the crack or fissure which they line.

(4.) Lastly, Vein Quartz occurs in indefinite lenticular masses and strings among the strata of many geological formations. Thus, occasionally it may be seen to occur between the planes of bedding of stratified rocks, more frequently, however, traversing those planes in an irregular and stringy manner, and sometimes much developed along the cleavage planes, as may be seen in the Skiddaw Slate between the summit of Hindscarth and Scope End.

Quartz as a Rock-Constituent.

(a) Of Stratified Rocks.
(b) Of Unstratified Rocks and Volcanic Rocks.

(a) Of Stratified Rocks.

In the Skiddaw Slates there are many parts—especially the lower, seen on Whiteside and Grasmoor—which have been produced by sandy or gritty deposits, and the grains of quartz may frequently be distinguished clearly with the naked eye. Again, in a well marked bed of grit, in the upper part of the Skiddaw Series, to be well studied in Great Cockup, north of Skiddaw; in the sides of the northern *breast* of Skiddaw; and notably at Lank Rigg and Latterbarrow, in the south-west of the Lake District, the grains of quartz frequently approach the size of small pebbles. In all these cases the quartz fragments are more or less rounded, showing that they have been rolled in the water, and are formed of white quartz, such as occurs in veins, or such as may be won from the disintegration of granite. Even in the clay-slate proper the microscope reveals the presence of small grains of quartz amongst the aluminous matter.

In some of the beds of Carboniferous Limestone that wrap round the mountainous tract, quartz occurs both in the form of small pebbles, and of curious amorphous masses very similar to the flint in chalk, but known as chert. In the sandstones interstratified with the Limestone, quartz in more or less rounded grains, is the chief constituent. In the Penrith Sandstone, of younger age

than the Carboniferous, the small grains of quartz are specially interesting, because, in some parts of the sandstone, at any rate, each grain shows the form of a doubly pyramidal crystal, the crystals being of very uniform size, and their form often not a great deal affected by rolling. Whence these little crystalline particles could have been derived, to form the sandstone, is somewhat of a puzzle. Among the Blue Mountains of New South Wales, Darwin observed a similar case, and remarks, "It is difficult to imagine how these crystals can have been formed; one can hardly believe that they were separately precipitated in their present crystallized state. Is it possible that rounded grains of quartz may have been acted on by a fluid corroding their surfaces and depositing on them fresh silica?" The silica in old glass sometimes regains its crystalline structure, as shown by Sir David Brewster in 1840.

(b) Quartz as a Constituent of Unstratified and Volcanic Rocks.

1. *Among Granitic and Granitoid Rocks.*

Generally speaking, in true granites, quartz occurs uncrystallized, being the last of the constituent minerals to solidify; it then appears to fill up all the interstices of the other minerals, the felspar and the mica. This is the case with the Skiddaw, Eskdale, and Shap granites in the mass, though sometimes very locally or in the form of dykes proceeding from the main mass, the disposition of the quartz is not interstitial but crystalline. This latter mode of occurrence may be well studied in the Quartz Felsite of St. John, and notably in the Armboth Dyke. In these cases the quartz and some of the felspar have crystallized out in a felsitic base, and the cross sections of the quartz crystals often look nearly square, from the unequal development of all the six sides. In the Armboth Quartz Felsite Dyke the embedded crystals are most clearly seen, and the pyramidal termination of both ends may be well observed.

2. *Among intrusive Diorites, Dolerites, &c. (Greenstones.)*

I know of no cases of quartz occurring in a crystalline condition in the rocks of the Greenstone class. Nor is quartz generally a conspicuous constituent in any form among such rocks.

Microscopic study of the class, however, reveals the very frequent existence of this mineral in small portions among the other constituent minerals. In some cases its presence may be due to deposition subsequent to the first formation of the rock, and such belong to our next group.

3. *Quartz as an accidental constituent.*

By an accidental constituent is meant one that forms no essential part of the rock, but has been introduced perhaps long after that rock was formed or solidified. Its manner of occurrence in these cases clearly shows that the quartz has been deposited from solution—water containing silica infiltrating through the rock-mass. It thus fills up cavities, and sometimes replaces other minerals dissolved away.

Among the Volcanic rocks of the District, quartz is very common in this form. In beds of lava, and sometimes in those of volcanic ash, vesicles or long almond-shaped cavities are generally produced by the escape of vapour and gases from the molten or heated matter, on its first eruption from the volcano. Subsequently when such lava beds have been covered up by great thicknesses of overlying strata, the water which is for ever percolating the crust of our earth, and contains very various mineral substances dissolved in it, deposits these in the cavities and vesicles, and amongst other minerals thus left to fill the vacant spaces, quartz is very common, and may often be found filling the same vesicle together with the minerals calcite (carbonate of lime) and chlorite. When a large vesicle has been thus filled with quartz, variously coloured and under different physical forms, it sometimes happens that the surrounding rock is subsequently broken up and destroyed, and then the hard kernels of quartz are isolated in the form of agates. Such are the agates of Wallow Crag, Keswick.

II. QUARTZ AS A MICROSCOPIC STUDY.

Having enumerated the various forms and conditions under which Quartz is found in the Lake District rocks, I wish to say

something about its internal structure as revealed by the microscope. The method of study is this. The fragments of quartz, or the rocks containing quartz, are sliced very thin and mounted; the slice being reduced to such a degree of thinness as to allow of its ready examination by transmitted light.

At the outset let us find out what can be the difference between a piece of opaque white quartz and clear transparent rock crystal. The difference is somewhat similar to that between a piece of opaque ice and a piece of glassy transparent ice; for if water be frozen very quickly, a large number of air-bubbles will be entrapped; while slow freezing enables the air to escape. Or again, take a handful of snow, it is white but decidely opaque. Though formed of clear crystals of ice, air is so mixed up with them, that the rays of light constantly suffering reflection from the limiting surfaces of the two, are unable to pass through the mass. Subject such a mass of snow crystals, however, to powerful pressure, the air will be squeezed out, and the formerly opaque snow may be converted into a block of transparent ice. Reverse the experiment, pound up your block of clear ice, and once more you have an opaque white powder, the minute icy particles being separated from one another by air. The same may be done with a transparent quartz crystal: grind it to powder, and the powder is found to be opaque and white.

Hence may we not conclude that the difference between clear rock crystal and opaque white vein quartz is that, while in the case of the transparent quartz, there is nothing, or but little, to reflect the rays of light, or to prevent their passing uninterruptedly through the mass; in the case of the opaque white quartz, there must be something included which acts in the same manner, as the air-bubbles in opaque or cats' ice, as it is called. The microscope reveals what this something is.

Take a piece of ordinary vein-quartz, and examine a thin slice of the same; every part of the field of view is seen to be full of little cells of very various form, some round, some long drawn out, some branched, and some even having a regular and what appears like a crystalline outline. Examine them more closely,

and each little cell is seen to contain a bubble, sometimes larger and more or less flattened by the sides of the cavity, and immovable; sometimes like the bubble in a spirit-level, moving sluggishly from end to end of a tube-like cell, and sometimes very small, and moving about freely in the cell like a thing of life, perhaps visiting all parts of the cell in turn, occasionally becoming hazy and indistinct, because, passing to a deeper part of the cell the bubble has gone slightly out of focus. If the cell, too, be very small, the bubble, owing to its extreme minuteness, may seem like a mere black speck, and in these cases the motion is exceedingly active, and reminds one still more of a living organism. What can these things mean? For a bubble to move thus freely about, all analogy would lead us to suppose that the cell must be full of liquid, except the bubble spot, otherwise this free motion would be impossible. What then is the liquid, and what does the bubble contain? Mr. Sorby has paid great attention to these interesting facts, and has clearly proved (1st) that the liquid in most cases is water; (2nd) that the bubble is a vacuum or empty spot, when the movement in the cell is very free; and (3rd) that the water is frequently saline, and sometimes the cells contain small cubical crystals of salt. Thus we have the astounding fact revealed to us, that in every small fragment of opaque quartz, there are thousands upon thousands of these minute liquid parcels shut up within it, and each containing a vacuous bubble. Again we ask—What can this mean? Can it be that water has had so large a part to play in the formation of this hard mineral quartz? that granite, which we used to look upon as a molten rock formed in the bowels of the earth, can yet have been formed largely in connection with water? for the quartz combining with felspar and mica to form granite, is literally full of these minute water-cavities. Let us see how this can be in the case of granite, and then other quartz occurrences may prove easier to understand. Mr. Sorby has made many and delicate researches into this subject, and he has found that on subjecting the liquid cavities to heat; first, any minute crystals of salt contained in them are slowly dissolved; and, second, that when the heat is made sufficiently extreme, the

minute bubble becomes smaller and smaller, until finally the liquid fills the whole cavity, the bubble completely disappearing. Now it is evident that these little parcels of water must have been enclosed within the quartz on its solidification, when the granite was being formed deep beneath the surface, for all geological evidence goes to show that granite is deep-seated in its formation; although of various ages, yet no other rock is ever found beneath it. Therefore it is further evident that when first enclosed, the water must have been in a highly heated condition, and unable to attain the state of vapour by reason of the great pressure to which it was subject; so that we may regard the liquid, now contained in the quartz, as part of the original mother-liquor, if I may use the term, which, together with a heated condition of other minerals, and great pressure, made up the conditions under which the granite was formed. In the formation of the granite, the two minerals mica and felspar were the first to crystallize, impressing their form upon the semi-molten or semi-fluid quartz, which solidifying last, wrapt up within itself large quantities of the highly heated water, in the form of minute liquid parcels or cavities. Subsequently, on cooling of the mass, removal of pressure, or both, the water would cool; but being closely sealed up in glassy (quartzy) cavities or minute bottles, it could not escape in the state of vapour any more than at the first, but in its cool condition would occupy a slightly less space; in other words the contraction would leave a minute bubble or empty space (called, for convenience sake, a *vacuity*), which vacuity you will see must have a size proportionate (1st) to the size of the liquid parcel; (2nd) to the heat and pressure under which the fluid was originally confined. Hence, if it be found that in a number of cases the *relative* size of vacuities and liquid-cavities is the same, these relative dimensions give us a clue to the amount of combined heat and pressure under which the granite (or, to speak more accurately, the quartz of the granite) was formed. Here, then, is an interesting problem; but at the outset it appears that to find out the exact amount of either the heat or the pressure it is necessary to know that of one of these elements; thus, if we knew the pressure, and observed the

relative size of vacuity (or bubble) to liquid cavity, we should have the two elements from which to calculate the *heat;* or, if we could form a tolerably accurate estimate of the heat, and make observations on the relative size of vacuity and liquid-cavity, these elements would allow us to form some fairly correct idea of the *pressure* under which the rock was formed.

Now, by an elaborate series of investigations, Mr. Sorby has shown it to be very probable that the heat was not much greater than 360° C (680° Fah.), or not more than a dull red heat visible in the dark. We have already seen how the water in many cases contained when hot more mineral salts dissolved in it than could be so contained when cold, hence the small crystals of salt sometimes found in the liquid cavities; but Mr. Sorby has also called attention to the fact that crystals of the mineral called Schorl (a variety of hornblende) are frequently enclosed in the liquid-cavities, and that these would be fused at any temperature greater than a dull red heat; and from this and other facts, he has fixed on the temperature of 360° C (680° Fah.) as the probable extreme at which the quartz of granites was formed. Calculating on the basis of these elements, and having made a large number of observations upon the relative size of the vacuities and liquid cavities in the quartz of the Cornish granites, Mr. Sorby arrived at the conclusion that the mean of the pressure expressed in feet of rock under which the Cornish granites were consolidated was 50,000 feet (this not necessarily the actual depth at which formed).

A few years ago, being anxious to apply Mr. Sorby's method to the granites and granitoid rocks of this lake country, I examined a number of slices of our granite rocks, and measured nearly 500 cases of liquid-cavities, ascertaining the relative size of the vacuity (or bubble) to the liquid cavity. My method of proceeding I will describe directly, but I will at once state that the result arrived at in the case of the Skiddaw granite, for example, was, that its consolidation took place under a pressure of rather more than an equivalent of 50,000 feet of rock; and that the *mean* pressure, under which all the principal granitic and granitoid rocks were consolidated, was equivalent to that of 44,000 feet of rock.

My experiences in the course of this investigation may be of interest to some who wish to undertake original work of a similar kind. (For the Memoir containing the investigation as a whole, see Quarterly Journal of the Geological Society, vol. xxxi. p. 568.)

The object-glass generally used was a ¼-inch (by Collins) with a C eye-piece, the combination magnifying 665 times. When I first began my measurements, I used a neutral-tint glass reflector, and traced on paper all the best defined fluid cavities, making a note by the side of those in which the vacuities showed a constant spontaneous movement. I soon found, however, that on a comparison of a considerable number of drawings, the fixed bubbles were almost invariably relatively larger than those which showed this free movement. Hence I was led altogether to reject from my measurements all cases in which the bubble was fixed, and in which it would seem either that gas had been primarily entrapped, or that in the making of the thin slice, leakage had occurred in the cavity. This last case must necessarily often occur in the making of thin slices, especially as the liquid-bearing cavities are frequently so irregular in shape and prolonged into horns and fine points. I then gave up tracing the outlines of cavities on paper, and measured the relative size of bubble and liquid-cavity directly, by means of a Jackson's micrometer, with divisions equal to $\frac{1}{1000}$ths of an inch. This micrometer being placed in the eye-piece, the fine divisions could be brought over the bubble and liquid-cavity, and their relative size at once estimated with tolerable accuracy. But a little consideration will make it evident that measurement of a liquid-cavity in one plane would be of little use unless the cavity be exceedingly shallow, and lie along the plane, hence it became necessary to take this further precaution, viz.—to rely only upon the measurements of those cases in which the tiny bubble (or vacuity) moved freely into all parts of the liquid-cavity without going out of focus; this would imply that the cavity was of tolerably uniform depth, but little more than the depth of the diameter of the bubble. And it was found that when I restricted my measurements to these cases, there was a fairly marked uniformity in the ratio between vacuities and liquid-cavities occurring in the quartz

of the same rock. Thus, take as an example two different rock-slices of the same granite :—

No. 1	·154	·162	No. 2	·166
	·154			·125
	·154			·166
	·166			·180
	·180			·200
	·180			·166
	·154			·166
	·154			·166
				·154
				·166
				·142
				·142

·164

In No. 1 there are five cases in which the whole liquid-cavity is 6½ times the size of the vacuity, one case in which it is 6 times the size, and two cases in which it is only 5½ times. The mean ·162 is probably not far from the truth.

It may be difficult to realize the size of these liquid-cavities and their contained bubbles. Those reliable for measurement are extremely small, sometimes less than $\frac{1}{10000}$th of an inch in diameter. Much larger cavities generally occur in plenty; but these seldom exceed $\frac{1}{2000}$th of an inch in length, and in them, the bubbles either have no movement, or but a very slight or sluggish one. In fact, such is the minuteness of these cavities and their number, in many cases, that more than a thousand million might be contained easily within a cubic inch of quartz, and sometimes the contained water must make up at least five per cent. of the volume of the containing quartz. In some cases the liquid-cavities are much arranged along lines, as in the quartz crystals occurring in the Armboth Dyke. Occasionally, however, liquid-cavities are met with in quartz crystals of very considerable size, such that the movement of the bubble can even be recognized by the naked eye.

Having accumulated a sufficient number of reliable measurements, and struck the mean for any one rock, such as the Skiddaw Granite, the calculation of the pressure under which the granite was found is proceeded upon by mathematical formulæ furnished

by Mr. Sorby's investigations, the temperature of a dull red heat visible in the dark (680°F.) being assumed as the probable temperature of consolidation. The result, in the case of the Skiddaw Granite, is that a pressure equivalent to 52,000ft. of rock must have been necessary to compress the liquid so that it would fill the cavities at a temperature of dull red heat.

The next question, bearing upon this result, is one for the field-geologist alone to determine. What is the greatest thickness of rock which can have been removed from over the mass of the Skiddaw granite as we now see it exposed? Geological investigation of the whole district leads me to infer that at one time the granite must have been covered by some 30,000 feet of rock—including Skiddaw Slates, Volcanic Series, and Upper Silurians. But we have seen that the calculated pressure is equivalent to 52,000 ft., hence the pressure to which the consolidating granite (and therefore quartz) was subject was greater than what could be due to the mere weight of overlying rocks. How then was this pressure applied? We have seen that the condensed liquid confined within the quartz has remained as a registering thermometer, to show the existence and amount of the pressure, and geological examination of the District further informs us that the overlying 30,000 feet of rock was in some way elevated, and contorted—being also slowly removed by denudation. Thus we have physical evidence from two different sources of the existence of great pressure exerted upon the granite-forming mass; evidence derived from the liquid-cavities and their contained bubbles, and evidence in the rocks overlying the granite of such pressure having produced elevation, contortion, cleavage, and general metamorphism. It is further interesting to notice what would be the probable heat at a depth of 30,000 feet, according to our estimates of known increase on descending through the crust of our globe. If we take that increase as 1° Fah. for every 49ft. (Mr. R. W. Fox, Brit. Assoc. Report, 1857, p. 91), we find that at a depth of 30,900ft. the temperature would be 360° C. (680° F.), or that of a dull red heat visible in the dark, and just the temperature at which we were supposing the granite was formed. Thus, to sum up our results in the case of the Skiddaw Granite :—

1st. It is probable from geological evidence that this granite was consolidated at a depth of about 30,000 feet.

2nd. An increase of 1° for every 49ft. on descending gives a temperature of 360° C. (680° F.) at a depth of 30,900 feet.

3rd. Microscopic evidence, deduced from examination of the liquid-cavities in the quartz, gives a calculated pressure, under which the quartz was consolidated, at a temperature of 360° C. (680° F.), equivalent to 52,000ft. of rock.

4th. As the calculated pressure thus far exceeds (by 22,000 feet) that due to the estimated thickness of overlying beds or—what is the same thing—to the estimated depth at which the granite-formation took place; it follows that there must have been a great amount of available pressure to be exerted upon the rocky crust around, and hence we find evidences of folding and contortion of the rocks, and of their upheaval and general metamorphism around the granitic area.

The case of the Skiddaw Granite will suffice as an example of this mode of treatment. I have elsewhere (Quart. Journ. Geol. Soc., vol. xxxi. p. 568) treated all the other granitoid rocks of the Lake District in the same way, and with very similar general results. There are yet, however, one or two points I should like to call attention to.

The first of these is the general absence among the liquid-cavities in the quartz of Lake District rocks, of crystals of various salts, such as have been found *in plenty* in some other districts. Are we to infer from this that the liquid enclosed at the period of the formation of the granites was less saline than in some other cases? Or is it possible that a more extended investigation would make it appear otherwise? Another thing worth noting is the general absence, as far as I have been able to judge, of cavities in the quartzes containing—not water—but liquid carbonic acid which in some other rocks and other districts are not infrequent.

While thus calling attention to various points connected with the formation of quartz-bearing rocks of the District, I am far from claiming to have examined into the question exhaustively, and would gladly see other workers take up the subject more completely, and either prove or disprove the results already obtained.

It is evident that microscopic examination throws light not only upon the origin of such quartz-bearing rocks as granite, but also upon that of quartz as an accidental and accessory mineral among rocks, and upon the mode of formation of quartz veins. We are in fact led to see that heated water containing silica in solution has played a most important part in geological history, that such water has sometimes been diffused through a rocky magma at a dull red heat under enormous pressure, and finally become entrapped in millions of minute cavities *in* the solidified rock; sometimes it has worked its way up along cracks and fissures and deposited quartz in those fissures, forming veins; sometimes circulating throughout the mass of a rock it has deposited the quartz in all irregular cavities or vesicles at a less degree of temperature; and finally, we recognize the same heated water fully charged with silica rising to the surface in the form of the Geysers of Iceland, and playing a large part in all volcanic outbursts. Surely there can be few thoughts more surprising than this, that every piece of granite we pick up contains in its quartz particles thousands of minute liquid-cavities, and moreover that every such liquid-cavity includes a tiny vacuous bubble in constant tremor or active motion, such motion, it would seem, having been kept up for the countless ages since the granite was first solidified deep down in the bowels of the earth. Truly we learn great things from study of the most minute.

BOULDER CLAY.

By Charles Smith, M.R.I.A. F.G.S.

(Read at Whitehaven.)

Until the past few years, the so-called Boulder Clay deposits were comparatively little studied. More recently this early neglect has been amply atoned. They might even be said to have been too much studied, as many have worked upon them in order to extract arguments in reference to subjects which are altogether extraneous. The deposits are doubtless directly or indirectly of glacial origin, these involve a "Glacial Epoch," and it has been endeavoured on astronomical bases to calculate the time which has elapsed since this ice period existed. Further, it has been assumed that proofs of the existence of man may be found anterior to the close of this epoch, and thus those, who have adopted theories for or against the antiquity of man, have made the boulder clay formation a battle ground for ethnological discussions.

The first question for us to examine is, What is Boulder Clay? Over a considerable portion of Northern Europe, as well as in North America, we find that though the great slate, sandstone, granite, or other formations appear on high ground, yet at lower levels they do not form the absolute surface (irrespective of the superficial beds of soil and disintegrated material); but between the soil and the foundation rocks there occurs, in very varying thicknesses of from a few feet to hundreds of feet, a peculiar clay, in which a greater or less number of boulders are contained. The clay is of different colours, but usually very tenacious and fine-grained; the stones may be of one kind only, or, as in our Furness

district, form a heterogeneous assemblage of various rocks, mixed in perfect confusion. It is natural that when local students meet with such wonderful collections of rocks as are contained in the Boulder Clay of this and the adjoining districts, that they should endeavour to unravel the mysteries of their appearance,—the why and the wherefore of their presence, their derivation, and the mode of transit from their far-away homes to their present *locales*.

Perhaps it would be impossible to find better opportunities for studying these deposits than are presented on this north-western coast. Here we find a stiff hard clay enclosing these various rocks, which are usually more or less sub-angular, and not unfrequently are scratched in a peculiar manner—the well-known glacial striae. There is no regularity in the deposition of the beds, large and small stones are mixed heterogeneously together without, in the typical deposits, any stratification or bedding in them or the clay. Water has undoubtedly been the motive power that has brought together these various materials; but water as water has a wonderful sorting faculty. The fine particles are carried farthest, the coarser portions to a less distance, whilst larger blocks travel but a little way comparatively from their parent home, until from some cause or other they are broken up, and their constituent parts travel farthest in inverse proportion to their size. Water as water cannot have laid down a deposit of the finest mud interspersed with huge boulders. We are therefore driven to assume that ice must have been the proximate cause of the formation. This explanation, however inevitable, by no means clears away our difficulties; we are but landed amongst phenomena which are in general most difficult of elucidation, and in many cases have as yet received very unsatisfactory solutions.

When the glacial origin of these deposits was first surmised, it was, I believe, generally assumed that they were the remains of icebergs which had melted in the respective localities. But this hypothesis proved highly unsatisfactory. It required immense depressions of the land to allow of the flotation of the icebergs, which in many instances could scarcely be granted. Icebergs in general contain an infinitesimal proportion of débris, quite in-

sufficient to account for the enormous European and American deposits of boulder clay on any reasonable grounds. If icebergs brought the stones from the Arctic Circle, they evinced a most extraordinary reflective power, as they invariably deposited their burden of rocks where counterparts could be obtained *in sitû* in not distant localities. As the iceberg theory is thus untenable, we are compelled to assume that the Boulder Clay deposits owe their origin more or less to land ice, which we must now examine.

Undoubtedly there was a time, geologically speaking not long ago, when a great portion of Europe was swathed in ice. Some astronomical geologists think that such epochs occur in cycles, and fancy that it may be possible to predict the period when our beautiful Lake Country will once more be sealed with a coating of ice, and when England will be as desolate as the interior of Greenland is now. Happily this is placed so far in the future that we need not personally make a trouble of the matter. We may calmly examine the data of the past by the light of the little knowledge we possess of what is now going on in the cold polar latitudes. We are in a tolerably warm cycle now. The ice, which enveloped a great portion of the British Islands, North Germany, Switzerland, Italy, and perhaps France, has shrunk till the glaciers of the highest mountains are alone left for our examination, and to study it thoroughly we must go far away to the northwards, where physical difficulties present insurmountable obstacles to exhaustive investigations. The same circumstances have taken place in the southern hemisphere. Great as are the obstacles to examination in the north, they are as nothing when compared with those which are encountered in the southern polar regions. Beyond the facts that the cold is intense, that a continent is buried beneath ice, and that great ice barriers exist for hundreds of miles, our knowledge is too vague and superficial to warrant any scientific deductions being drawn, which could be utilized in our present enquiry. Although more is known about the Arctic Circle, yet it is but very little; and for information as to the action of land ice, perhaps Greenland is the country whence we may best derive data suitable for our purpose. But our know-

ledge is very limited, and we must be careful not to assume too much from observations that may not be entirely accurate.

It is known that Greenland, speaking generally, is covered with one vast mantle of ice, which in places attains enormous thickness. Snow falling inland is converted sooner or later into ice, and the drainage of the country is carried on by means of an unceasing downward motion of the ice towards the sea; but in thus acting, hills are crossed over, and valleys filled to an extraordinary degree, so that the upper surface of the ice is comparatively level, as compared with the actual contour of the country. As the ice sweeps down to the coast it will be thinner on the high ground, assuming that it covers the crests, but the valleys will be filled up with ice to a depth that we can hardly appreciate. As the huge streams of ice, which may be two thousand feet thick, come down to the shore, they press onwards over the sea-bottom. The farther they go, the greater is the inclination of this seaward portion to rise to the surface, owing to the greater lightness of ice as compared with water, until the moment finally arrives, more frequently in the summer, when the cohesion of the mass fails, enormous fragments break off, rise in the water, and float away to melt on the banks of Newfoundland. Any examination of these bergs is a difficult matter; but we may assume that though they frequently contain considerable quantities of rock materials, yet, comparatively, this amount must be very trifling. Grottoes in Swiss glaciers show the ice almost free from visible impurities, and we may well believe that Greenland icebergs are no less pure than Swiss glaciers. Nevertheless, though the ice be clear as crystal, and though we know nothing at present as to deposits forming in front of these ice sheets, there must be enormous denudation going on, caused by the unceasing movement over the surface of the land of its icy shroud, ever scraping off irregularities, and rounding every protuberance. If we attempt to imagine this ice action in Greenland, we may perhaps suppose that it has so long continued, that most of the irregularities are now planed off, and that the work of the ice will be mainly confined to grinding the rounded or level surfaces of the rocks. Weathering will doubtless bring down

immense blocks from mountains too precipitous to allow of the accumulation of snow or ice, and these would travel down the glacial valleys in the form of moraines; but the quantity must be relatively small, and the question may be raised whether stones can travel any distance along glaciers and escape falling into the crevasses. There is also great waste along the sea-cliffs, as is seen in the so-called "ice-foot," or masses of ice, perhaps, partially, frozen sea water, which adhere to the lower margin of the cliffs and become laden with stones, broken off from above by the action of frost. But these losses of the land are comparatively of little account, and we may conclude that a country such as Greenland, completely clothed in ice, must be suffering far less from atmospheric action than any land, even in the most favoured climes, which is exposed altogether. There is then to be considered the scraping action of the ice sheet, which must be enormous to a degree beyond our comprehension in the earlier portion of a glacial epoch. We may suppose that where this action is long continued, the denudation must very materially decrease, when once all the asperities have been worn off, and the work of the ice is confined to grinding the rounded surface of the subjacent rock.

We have now arrived at another stage in our enquiry. In what form is the material carried away by the ice, and in what manner is the transit effected? We will first consider the stones that fall down crevasses. What becomes of these? It has been suggested that stones which from this cause become embedded in the ice, gradually rise in the glacier and appear once more at the surface. This seems a very hazardous conjecture, and if it were true, the surface of glaciers should be pitted over with stones just emerging into daylight from the bosom of the ice. We know that such is not the case. Neither can the stones retain a horizontal position, as the ice at the end of glaciers is free from impurities, whether stones or dirt. But the vast heaps of moraine matter which fall down crevasses must go somewhere; and if the rocks neither rise again, nor remain horizontal, they must sink to the bottom, either to be ground into an impalpable powder, or to form

a bottom bedding to the ice, and if this latter theory proved to be true we might here have the origin of many of the rocks in the boulder clay.

We may perhaps take it for granted that an ice cap causes immense denudation, but it may not be so easy to describe the *modus operandi*. In what form is the material ground off? We cannot examine the foot of the Greenland land ice, but we can do this with the more accessible Swiss glaciers, from the end of which usually rushes a thick turbid stream, holding in suspension a large amount of mineral matter. We may perhaps suppose that as the ice crushes over the rocks, grinding off infinitesimal portions, most of the débris is carried away by the streams which it is thought are at least not uncommon beneath the ice; or if the theory were true that stones rise in glaciers, why should not the impalpable powder, which has not lost its specific gravity by grinding, be pressed by the weight of the superincumbent ice into various interstices, and rise slowly to the surface; but this supposition is negatived by the crystal clearness of the ice, wherever examined beneath the surface. It might be that the worn off material accumulates between the ice and the rock in the form of a fine mud. This mud might to a limited extent be collected in the hollows or places where temporarily the main pressure might not be, but would always be liable to be carried forwards and downwards, never remaining permanently stationary. It scarcely seems possible that this layer of mud could accumulate to any thickness. If such were the case the grinding action would cease, as the mud would protect the subjacent rock. A greater difficulty even is to suppose conditions which would allow of ice two thousand, or even two hundred, feet thick, resting on soft clay and yet not scouring it out, so that the ice should once more rest on its rocky bed. This last proposition may sound plausible, but if we grant it, shall we not, of necessity, have to reject the prevalent opinion that boulder clay was formed *beneath* land ice, though it is very difficult to picture circumstances when such a formation could take place. The boulder clay is, however, an actual fact, and the more mysterious its origin, the more in the nature of things shall we unceasingly attempt to solve its presence.

It appears to show evidence of having been subjected to great pressure. We know of nothing except this ancient ice cap, which could have exerted this pressure, yet we can scarcely consistently allow that if this shroud of ice has the power to smooth every protuberance, to widen and deepen valleys, and even grind out immense lake basins, that with still greater facility it would not carry with it all loose non-compact matter, and prevent any such accumulation except in protected hollows. So many of our difficulties would be removed if we could only see the formation of boulder clay going on. We may examine limestones, sandstones, and slates in their most incipient stages; but though such immense areas are covered with boulder clay, and doubtless deposits are now being made, yet there is not one authenticated case of boulder clay having been seen in process of formation, nor has it ever been noticed *in sitû*, with ice in whatever form resting upon it. It is nearly always impossible to examine in the smallest degree the lower portions of glaciers or of sheets of ice; but so far as has been observed, it is not known that anything intervenes between them and the subjacent rock, with the possible exception in a few cases of an assumed "pavement," or consolidated bed of rolled stones. Then in examining glaciated countries, the smooth rounded contours, with the striated markings on the polished rocks, are surely more probably the results of the passage over them of enormous volumes of ice, containing isolated embedded stones which would account for the striae, rather than that a confused bed of clay and stones had been dragged across the surface by the unceasing movement of the restless mass above. It is possible when land ice descends from high ground and *débouches* on a level plain, that its progress may be much checked and its speed much lessened, which would necessitate that the ice on the lower levels should thicken correspondingly, and that thus in some way a deposit beneath might be formed; but even this supposition is fraught with many difficulties, and may hardly be tenable. However slowly the ice moved, it still would move, and the underlying clay with it. If so, we should have this further question to deal with. It is believed that during the glacial epoch there were

several centres of ice action; that the Scandinavian mountains sent out huge streams that flowed in one continuous sheet into the Baltic, invading North Germany, and spreading along the floor of the North Sea until it coalesced with the land ice proceeding from the various mountain groups of the British Isles, till at last, with the possible exception of portions of high ground, Scandinavia and Britain, with part of Germany, were enveloped in the same shroud of ice. Were this the case—and the evidence is very strong—and we grant that boulder clay forms beneath the ice and is carried along with it, at the warm latitude where the latter melted, there would have been prodigious accumulations of débris, gathered indiscriminately from the Arctic Circle, Scandinavia, and Britain: but none such exist. What then became of the Scandinavian débris, if it did not intermingle with the spoils of the British Islands?

In this hasty review of some of the main features of glacial action, our chief impression must be how little we know, and in what numberless directions research may be made; but we have chiefly considered matters which refer either to distant ages, or to far off lands, which are beyond our observations. Let us now examine the boulder clay formation as we find it in our own day, the product of forces we are not yet able to explain, and about whose origin, though amongst the newest of geological records, we know less than of some of the most ancient of rocks. The boulder clay varies in colour and composition, according to the general characteristics of the neighbouring hills, but its mode of occurrence seems fairly constant. It consists of either one or two beds of true boulder clay, with various deposits of sand and gravel. The lower beds are usually more compact than the upper ones, and more highly charged with stones; but this is not an invariable rule. Occasionally sections occur where a greater or less thickness may be seen, where there is little clay except in the interstices of what appears a compressed mass of stones. There are, however, no characteristics which definitely indicate respectively what are termed by the Geological Survey the Upper and Lower Boulder Clays; and in the memoir for South-West Lancashire, it is acknow-

ledged that where there are no sand or gravel beds, it is extremely difficult to determine their respective horizons. Sometimes the boulder clay may be slightly stratified, but usually there is not the remotest appearance of stratification, the stones being mixed pell-mell in the clay without the slightest order, and they are almost invariably either rounded or sub-angular, and not infrequently are scored with glacial striae. The sand and gravel beds intercalated with the boulder clay, occur with great frequency, and often with considerable constancy. They are assumed by probably a large majority of geologists, to occur both above and below true boulder clay, and have thus been termed Middle Drifts. They are very complex in their characteristics, often contain fossil remains of warmer than Arctic types, and present extreme difficulties in many respects. If we grant that there are two deposits of undoubted boulder clay, the product in each case of the extremest cold, during which the country was enveloped in an ice sheet that must have stifled all life, except the most hyperboreal forms; and that these two epochs were separated by a period of milder climate of sufficient duration to allow of the immigration of numerous forms of life, which during the preceding glacial epoch could not have existed in any near vicinity, we are compelled to grant an enormous period of time, and such immense physical changes, as we are only warranted in doing on the most indisputable evidence. I fear that in geological matters we are too ready to assume on the slightest pretext gigantic changes, that could only occur after the lapse of incalculable ages; possibly the simplest geology is the best, and more extended research and greater knowledge will undoubtedly tend to abolish theories which constantly require cataclysms, and to substitute in their place the slow silent agencies which we may see every day at work. We have some slight evidence in the earlier stone-records of other glacial epochs, but we have no foundation to assume that there were many of them, and we should be very careful as to our evidence before we affirm that there were two glacial periods, comparatively speaking, close together, and in the very latest chapter of geological history. If boulder clay formation could be proved to be the product of one

glacial epoch, matters to that extent would be much simplified, and it may be wise in our explorations if we ask ourselves whether the observations we may make will not fit in with the more simple, as well as with the most complex theories. Doubtless these so-called Middle Drifts are most difficult of explanation, so much the more must we patiently examine them, and not be too ready to draw rash conclusions. They have already given rise to innumerable discussions and disputations, whilst the most opposite theories have been derived from them. In Ireland some members of the Geological Survey think that the Boulder Clay in that country may be divided in such a manner that it may only be necessary to assume one glacial epoch, which was succeeded by warmer conditions, with the sea at higher levels, and that this period was that to which we must attribute the so-called Middle Drifts, whilst in addition there is much moraine matter due to local glaciers from the high ground. If the results of years of study in Ireland have led to these conclusions, may we not hope that the same may be the case later on in England, especially when we remember that the author of the Geological Survey memoir for the south of our own district acknowledges the extreme difficulty of determining over large areas whether the so-called upper deposits are Upper or Lower Boulder Clay. Doubtless in Furness there is the appearance of sand and gravel beds separating the Boulder Clay into two great divisions, but no palæontological evidence has yet been adduced in support, and it may be that as in Ireland we may have a threefold division, and that in our district what has been taken to be the Upper Clay may partly be of moraine origin, and partly, with the underlying gravels and sands, may be the work of the sea, re arranging the old boulder clay beneath, though this suggestion would be difficult to reconcile with our present knowledge. There is here room for much study, and I believe that there are not a few students who are ready to work on the subject, and we must hope that the result will be that within a few years the tangled history of this portion of the past will be unravelled, when we shall see the true bearing of these disputed beds. Clearly there is much to learn, when even the origin of the deposit is

undetermined, and we have to seek for a hypothesis that shall account for the formation of beds of great thickness of finely comminuted clay, enclosing incalculable quantities of rounded or sub-angular boulders. The clay we might believe to be the product of the grinding action of ice, but we know of no glacial influences that would cause the boulders to be rounded, an effect solely due to marine or fluviatile agency; but rivers can have had no share in this instance, and we are left to look to the sea alone for an explanation. Is it possible that when this vast accumulation was brought down from the high ground, that the ice came down to the sea, which in this district was, at the beginning of the formation, at a lower level than now? that the mud ground off the rocks was deposited in a zone near the shore, which was constantly sinking? and that the rocks and stones, brought down as moraine matter were, before their final entombment, subjected to the rounding action of the sea? If this process were continued, and the land sank to the great degree that is assumed by most writers, but little would be left above water, and perforce the deposit of glacial matter would nearly cease as the country sank beneath the waves, which would melt its icy covering. Then may have been formed the sand and gravel beds, the result of the sea disintegrating the previously deposited boulder clay, and re-arranging the materials. But the movement of the land changed, the period of subsidence was ended; and slowly our mountains once more emerged from the sea; as they did so, they would present more and more surface for the formation of glaciers and land ice, but the cold epoch was on the wane, and though the land rose to a degree nearly equal to the subsidence, the coating of ice never reached its former dimensions; still it could produce prodigious effects, and the so-called Upper Boulder Clay may be its witness. This theory practically harmonizes with the results mentioned as having been worked out in Ireland, and does away with the necessity of assuming two glacial epochs.

In studying the Boulder Clay formation, there are perhaps few districts that offer so many advantages as our own north-west coast. I do not know whether the members of the Whitehaven Scientific

Association have done much work in this direction, or whether they have left their President alone in his explorations; but in our Furness district, until twelve months ago, no one appears to have given the formation the least attention, or if the Survey officers have worked upon it, the results of their labours have been carefully hidden in the archives of their Department. The neighbourhood of Barrow is singularly favourable for making examinations; the formation is not one that is ever commercially explored, except for subsidiary reasons, and therefore with the chief exception of railway cuttings, we have to depend on the sea shore for sections, and in most places there will not be more than a dozen miles of beach within half a dozen miles; but at Barrow, in consequence of the configuration of the land, giving us Morecambe Bay on one side, the estuary of the Duddon on the other, and to seaward the long island of Walney, with other smaller islands, we have within half a dozen miles probably forty miles of coast,—thus we have most exceptional opportunities for exploring the Boulder Clay and its accompanying beds, which a number of the members of the Barrow Field Club, who are working conjointly on the subject, propose to take advantage of. When this joint action was first proposed last winter, it was more with the object of working on the contained boulders, rather than on the formation as a whole; but the field has widened at every step, and new subjects crop up in endless succession. Our first work, however, was with the boulders, to endeavour to find out their origin. Their variety was so amazing, and there were such numbers which at first we did not recognize, that most of our time has been occupied with these rocks, collecting them in their various forms and correlating them as far as possible with the rocks of the district. This was no easy matter; the boulders lie scattered in such absolute confusion, of many ages, and of the most varied composition, that a stranger would deem it impossible that such could all have had an approximately local derivation, and might hastily assume that the iceberg theory would most easily account for this extraordinary assortment of rocks. We determined as far as possible to collect every variety of boulder that could be found, distinguishing between loose

boulders from the shore and those *in situ* in the clay, and at the same time making ourselves acquainted, as far as we could, with the rocks *in situ* in the district. We do not pretend, of course, that we have accomplished all this; we are, indeed, only on the threshold as yet; but so far as we have gone, we have not found amongst all these slates, limestones, granites, and traps, any rock that may not have been derived from the Lake district, with the single exception of what, for convenience we will term—vermiculitic granite. To prove the proximate derivation of the mass of boulders, it was very desirable, if possible, to find any that should possess such marked characteristics that there should be no question as to their origin; we therefore considered the vermiculitic granite as of special value in this respect, though as yet we have not been able to trace it to its parent rock. You will see from the specimens exhibited, that it might easily be mistaken for ordinary granite containing black mica, and it was almost by accident that the curious properties of some of the black crystals were discovered. The mineral was too uncommon and peculiar for us to bring it forward publicly, without having upon it more than local opinion. I sent specimens to the late Mr. David Forbes, and received from him, only a few days before his lamented death last year, a long letter, in which he stated his impressions that the mineral was a vermiculite, but if so, it was previously unknown to Great Britain; he thought the subject to be of considerable interest, and intended to have continued his investigations. After his death I took other specimens to the British Museum, where nothing was known as to any similar mineral having been discovered in Great Britain. It has now been found in several localities near Barrow, and also by members of our Field Club near Millom and at Nethertown. The granite in which it is contained is usually friable and partially disintegrated, or it may be that unless the granite be in this condition, the vermiculite is not so easily recognized. Possibly the Ennerdale district may be the home of this rock, yet if so, it is strange that the vermiculite has not been detected *in situ* by some of your Cumberland savants; but if this assumption as to locality be correct, I trust another summer will

settle the question. If this rock prove to be Cumbrian, it will be the strongest proof that we can offer as to the local derivation of the Boulder Clay, and should serve as another argument against the iceberg theory, that assumes that our district was a grand rendezvous for ancient bergs, which here melted and deposited their solid contents borne from the ice-fields of the Arctic circle; though this theory has received well-nigh a death-blow from the elaborate work of the Scotch Geological Survey, which has proved that the boulders in the deposits in that country are derived from the two great mountain districts of the north and south respectively, each within their own boundaries, except in a zone running across the central districts of the valleys of the Clyde and Forth, where the two great glacial systems coalesced, and where boulders from the north and from the south are intermingled.

We have scarcely begun the examination of the so-called Middle Drifts, deeming them perhaps the most difficult part of our work, and that it would be wiser to take first the simpler branches; and we find no lack of subjects, for the more we have done the more we see there is to do; or in other words—the more we have learned, the more we find we do not know; at every turn something fresh crops up, often leading far away into other fields of science. I do not doubt but that it will be found that these drift beds are, in Furness, a very difficult subject, as they are frequently of wide extent and of considerable thickness; as a sample may be taken, a very fine section of gravel south of Furness Abbey, about forty feet high, which is slightly stratified, and contains, in certain zones, large quantities of Red Hematite at a much greater altitude than any known deposit of that mineral in Furness; and I may here mention that we have found Hematite in several other localities several miles from the nearest known deposits, and occasionally in comparatively large quantities within small areas. If our Boulder Clay owed its origin to icebergs, it is indeed a strange vicissitude of fortune that large numbers of pebbles of a mineral so rare in quantity as Red Hematite, should be brought from the frozen north, to be cast on the shores of Cumberland and Furness!

One branch of the subject that we have had much under observation, is the travelling of the boulders, and this, again, opens out in various directions. The extent to which the boulders will travel, owing to marine action and the set of currents, is of necessity very obscure, and here we have more negative than positive evidence. For instance, we cannot watch a boulder in its submarine course, but if we find that certain classes of rocks never occur beyond certain limits, though the currents may be favourable, we may fairly assume that the rocks are not hard enough to bear the disintegrating process of the journey. Take, for example, an extreme case, which may be studied at St. Bees; doubtless large numbers of boulders of red sandstone set out southwards from St. Bees Head, but they are too friable to bear the wear and tear of even a short journey, and few survive the first mile of the route, except in the form of sand, when their origin would become problematical. I believe it is not yet known definitely to what distance boulders travel on this north-west coast. Have, for instance, all the loose boulders on our shores been derived from the boulder clay, or have some portion of them travelled by marine agency? We have an immense proportion of Eskdale granite, which gives rise to several questions—Did the boulder clay originally contain so large a proportion of these stones? or has their hardness preserved them whilst their brethren have been disintegrated? Have some or any of these travelled from Ravenglass? Again, is there a general roll southwards along the Cumbrian shore? and is the Eskdale granite the best fitted to withstand the wearing influences encountered?

We would thus require to assume that a predominance of boulders of one class does not represent their original proportions, but merely their superior hardness, which quality alone determines their longevity. All these are questions much easier asked than answered, and much observation will be needed to settle the points definitely. In reference to this part of the subject, it would be very desirable to know the various proportions of the rocks forming the boulders at points all along the coast, but so far the Barrow Field Club have not begun the collection of these data.

The question whether or not there is a general tendency of the boulders to travel southwards, is a matter of practical importance to us at Barrow, in reference to the harbour and the means necessary to keep the entrance clear for shipping. On the Cumberland coast, the extraordinary bank thrown up by the river Ehen, between itself and the sea, would appear to indicate that there is at least at that point a tendency southwards; though in opposition to this the Esk and the Annas have their banks facing to the north. The origin of the bank of the Ehen south of Braystones might perhaps be due to the configuration of the coast, in that when the sea rolls in against the cliffs, particularly during storms, the back water has to escape in the direction of least resistance, which happens to be the south, towards the point where the Ehen is emerging from its ancient delta or estuary, and the struggle between the sea and the river, meeting at an acute angle, might originate the bank; but it is difficult to see that these causes constantly acting, only at a point moving southwards, would prolong the bank to so great a distance as two miles. On the west coast of Walney there can be no doubt as to the boulders travelling to the south, as there is a remarkable annual increase of sixteen feet at the south end of the island, the material being derived from its more northern portions. The accumulation of boulders is enormous, and they lie in huge ridges like the waves of a stormy sea; very many acres are perfectly bare, without any vegetation or any sand or gravel in their interstices. They form an arm at right angles to the general trend of the island, the greater portion being covered by sand dunes; and as the accretion is so rapid, combined with other circumstances, I have come to the conclusion that this angle is extremely modern, possibly, or rather probably, not more than three or four centuries old. There is not the time now to state all the reasons for this conclusion, which I stated fully in an address given last month to the Barrow Field Club; but my general argument was that Walney Channel was the ancient course of the Duddon, and that Walney was then joined to Cumberland; were this suggestion to be correct, light is thrown on the location of Piel Castle, which doubtless was a fortress of great strength, and would scarcely have been built

where it is, if its relative position formerly had been as at present. Further, if this assumption were true, Walney Island forms a parallel, but on a larger scale, to the bank of the Ehen, and if so, it may prove that this large island is not true boulder clay, but that it owes its origin to marine and fluviatile action, or as has been suggested, there may have been small islands of boulder clay which have been joined by drift deposits.

In giving these particulars as to what is known or suspected as to the Boulder Clay formation, it must not be supposed that a tithe has been related; merely some of the most salient points have been noticed; I have also omitted all mention of many matters intimately connected with the subject, such as the astronomical theories to account for the supposed cycles of extreme cold through which the earth passes, as these suppositions are somewhat vague as yet, and depend upon abstruse calculations that future discoveries may prove erroneous. Neither have I referred to the palaeontological evidence as to the arctic condition of our climate, which is of the utmost importance, and may be taken as absolutely demonstrated. Nor have I given any particulars as to the so-called erratics or huge boulders, often of enormous dimensions, found scores of miles from their parent home, separated it may be by high ridges and possibly lying on the summits of high ground; their evidence is of immense value in investigations as to glacial action, and their position may be due to icebergs, or floating ice, of the period intermediate between the so-called Upper and Lower glacial epochs. Nor must we forget to make a passing reference to the subject of the Antiquity of Man, on which, in reference to the Boulder Clay formation, there has been such fierce discussion and such angry contention. All these are subjects that in themselves are sufficient for an illimitable number of papers.

In conclusion, I must apologize to you for the manner in which the subject of my paper is brought before you. But I have intentionally departed from the usual custom of attempting to explain everything. I may have erred on the other side; but my object has been to present the various matters touched upon in such

a light that you will feel they are inherently of great interest, and that very little is really known about them. Hard defined theories are stated positively, which often do not agree with each other, or with the most ordinary observations, and men of equal eminence hold absolutely opposite ideas on some of the fundamental points we have had under review. Our subject is one which must be treated broadly, and, above all, not from merely local standpoints. Observations at one place alone might give rise to the most fallacious opinions, and the facts collected in the most widely separated districts or countries must all be carefully weighed.

I do not doubt but that much remains to be discovered on this north-west coast, as to these Boulder Clay deposits, and the most effectual way to acquire the greatest amount of knowledge as to the formation, in the shortest time, and with the least expenditure of unnecessary labour, would perhaps be a properly organized examination by the members of this Association and of the Barrow Field Club. The purpose of this paper would indeed be accomplished if it should be the means of producing joint action between the two Societies, thus work would be economized and mutual assistance rendered in these explorations, which probably might lead to most valuable discoveries. If we work alone, we each may be wasting our strength where the other has been before, whilst if we both are aware of what each has decyphered of the dim records of the icy past, the result could not fail to be a confirmation of the old proverb that Union makes Strength.

SUBMERGED FOREST AT ST. BEES.

By R. Pickering, C.E.

(Read at Whitehaven.)

The submarine forest at St. Bees is situated on the sea shore nearly opposite to Sea Mill, stretching south-west from that place and diagonally from the coast line. Some years ago I noticed two small patches of peat bed on the shore, about four hundred yards northward and nearer Sea Cote. These patches of vegetable matter are, however, usually covered up with sand. Although a connection with the forest was not very evident, it occurred to me that, should the small patches of peat bed referred to, be a continuation of the forest, and if they underlaid the drift of which the adjoining cliff is composed, the deposit would be of great antiquity, and preglacial. My geological friends held various opinions on the matter, as well as to whether the forest was really a forest *in sitû*, or an accumulation of drift wood and other vegetable matter, such as is now forming on a large scale in the embouchures of the Missisippi. I felt inclined to attempt a solution of the problem.

The forest extends, with a dip seawards, for about six hundred yards, between the lines of high and low water-mark, and still continues to dip under water. The width varies from forty to seventy yards. Fully three-fourths of this surface is thinly covered with gravel and boulders, yet these are of sufficient thickness to prevent the forest being observed by persons previously unaware of its existence. A considerable portion has been denuded, and the process is still continuing. Seven bore holes were put down through the remaining stratum; the thickness varied

from two feet to five feet six inches. The vegetable matter is underlaid in places by a varying stratum of light blue clay, about one foot thick, in a great measure analagous in composition to the fire-clay beds often found under coal in the neighbouring coal-fields. One of the bore holes was put down at the edge of the shingle, five feet six inches deep; and immediately the vegetable deposit was perforated, water rose up to the surface. This was an important aid: it proved that the impervious vegetable stratum underlaid the shingle to a sufficient distance landwards to connect it with the stratum seen in the river bed of the valley of St. Bees. Along the greater part of the submerged south-east boundary, the forest lies on the thick red clay bed which underlies the drift of the escarpment to the south-east; its opposite margin, however, was not nearly so clearly defined.

On a consideration of the whole case, I am decidedly of opinion that the forest does not underlie the true glacial deposit adjoining, and that it is continuous up the St. Bees valley, as far as Stanley Pond, and even further, and that it lies under most of the flat or meadow portion of the valley. The underclay is succeeded by huge prostrate trees and roots, and then by decayed plants and peaty matter. A transverse section of the forest would present a concave line at the bottom, and this line indicates the eroded surface, resulting from long continued ice action during the glacial period. The underclay would be produced from the waste and decomposition of the rocks forming the hilly ground at the head and sides of the valley. It is probable that the lower part of the then valley would be partially blocked up, as the clay is lacustrine in character, yielding under the microscope the following species of Diatomaceæ: *Epathemia turgida*, *Epathemia granulata*, *Epathemia proboscidia*, *Pinnularia acuta*, and fragments of other species of this genus. These are all fresh water organisms, and all existing now in this neighbourhood, except the Epathemia granulata, which is peculiar to the Irish Bogs. A fragment of a marine species *(Cosinodiscus punctata)* was found, but this would seem to have been an introduction from the present sea. The submarine forest, as it is called, is really a forest *in situ*.

Clusters of roots of trees in an upright position may be seen. Oak, Alder, Birch, Fir, Willow and Hazel Trees have taken root and flourished in the underclay, and in turn decayed and been overrun with rank moss growth, along with gigantic reeds, and remains generally of lacustrine flora. Along the valley of St. Bees, some twenty years ago, the river was diverted from its then bed, or course, and a new course made. Wood, hazel-nuts, and other seeds were found in abundance under the alluvial soil, and peat may yet be clearly seen, opposite to Blythe Place in the river bed. Most of the Oak trees are very sound. The forest having fairly been established, as time sped on, the trees decayed and were covered up with decaying leaves and other vegetable débris, forming peat. This was ultimately surmounted by alluvial soil, the waste from the adjoining higher lands. With regard to the epoch of deposition, we have no means of measuring geological time in years and centuries, it is merely relative. We can, at the most, but say that one series of deposits is of earlier date than another series, or *vice versa*; and the terms early and recent, should be understood to be so only in a geological sense.

I think we may fairly class the "forest bed" and its underclay as belonging to the lowest division of the post tertiary or recent system, and consider it to be co-eval with the existence of the Irish Elk, the mammoth, and the long-fronted *ox* (all now extinct), and Man himself. Indeed it is quite probable that primeval man may have hunted the Irish Elk in the forest glades of this epoch, just as his compeer now hunts the buffalo on the prairies of the Far West.

The geological importance of these deposits is principally due to the aid they render in arriving at correct deductions as to the means whereby beds of lignite, coal, and clays of the earlier epochs have been formed. In this case a piece of *greenstone* was found embedded in the forest. Some time ago, considerable discussion ensued in influential quarters respecting the origin of boulders, fragments of quartz, and other rocks found embedded in true coal. The conditions at St. Bees favouring denudation are opposed to the consolidation of the forest form-

ations into lignite. It will be obvious to you all that a covering-up process would be the favourable condition.

This submarine forest growth implies a larger extension of the land formerly, and judging from the numerous recorded deposits along the coast, it may be fairly inferred that at no distant period a great part of the bed of the present Irish Sea was inhabited by the fauna, and adorned by the flora of the dawn of the present system. It is also evident that the climate was warmer and milder than at present. Trees would not now grow at Saint Bees at all approaching in size the giants entombed in the forest. It is possible that at that time Saint Bees might be many miles inland, and thoroughly sheltered; it is, however, also probable that the gales from the south-west were of a milder type than at present. Peat is a product of cold and temperate regions, arising chiefly from the growth and decay of marsh plants—reeds, rushes, equisetums, grasses, sphagnums, confervœ, and the like, being the chief contributors to the mass. Peat moss has a tendency to accumulate in all swamps and hollows, and wherever stagnant water prevails, filling up hollows and lakes, choking up river courses, entombing fallen forests and spreading over every surface having moisture sufficient to cherish its growth.

I make the following deductions. 1st. That at or about the close of the Drift or Pleistocene epoch, the land about Saint Bees was elevated considerably higher than it is at present, and placed beyond the influence of sea currents. 2nd. That the climate also at the same time changed from its arctic intensity to a temperature somewhat warmer and milder than that we now enjoy. 3rd. That the land extended to the west and south-west to a very great extent. 4th. That from the close of the Drift period to the present time the sea has not flowed in the valley of Saint Bees, despite all legendary tales to the contrary. 5th. That after the deposition of the forest, peat, and part of the alluvium of the valley of Saint Bees, the land has been much lowered; but whether such lowering is being continued at the present time, I cannot tell.

I will endeavour briefly to explain the character of the drift, as is shown at the mouth of the valley in the cliffs and railway

cuttings. There is a saying that every valley has its own peculiar drift, composed for the most part of materials torn from the parent rocks at higher levels in the same valley, always, however, having some extraneous material brought from a distance.

The valley of Saint Bees is an exception to some extent, inasmuch as a very considerable amount of the débris at Sea Mill has been brought from about Cleator Moor, Frizington, Weddicar, &c., these neighbourhoods having other valley lines of their own. The deposits near Sea Mill, on both sides of the forest, are of the roughest character imaginable, great blocks (both rounded and angular) of coal measure sandstones, Whitehaven sandstone, Permian conglomerate, Saint Bees sandstone, shale, limestone (both Carboniferous and Permian), and almost every other conceivable description of rock, all accumulated in the most promiscuous manner. A peculiar kind of rock is found in the débris called Mussel Bed. This material is probably brought from about the Griffin Inn at Frizington, where it crops out. It forms one of the measures of the Cleator Moor coal field. At Wyndham Pit (now closed), within the yard of the Hematite Company, the bed is forty-three fathoms below the surface, and about seven fathoms below the Main Band of Coal. It is 1ft. 9in. thick, and is a calcareous and ferruginous deposit, composed of shells resembling the fresh water mussel or unio. This was at one time smelted at the Cleator Moor Works. It contains about twenty-five per cent. of iron. Some of the rock fragments have the well known glacial grooves or striations on them.

Leaving Sea Mill, and proceeding towards the north along the sea cliff, we find the drift becoming finer and milder in type. It is, however, a strange agglomeration—clay, sand, and gravel, derived chiefly from its own valley line, shot down anywhere, and in any form, and in places partly rearranged by water in short lines. At the time of deposit, an immense amount of rounded coal has drifted, in such abundance as to form beds one foot in thickness and upwards. I have found this to hold good at New House Brow, in the Ehen valley.

During this last winter, after the heavy tides had partly wasted

the rubbish away at Wellington Pit, I was struck with the resemblance it bore to the appearance of the finer drift in these escarpments. It would appear that the material had been dropped into the sea by icebergs in masses, and then partly arranged by the currents.

As we proceed to Sea Cote, still further northwards, the drift has been influenced by the Rottington Valley. The rocks from that valley being mostly Saint Bees sandstone (Permian), we have red clay and sandstone gravels predominating, but deposited as irregularly as before.

I have omitted to describe the thick red conglomeratic clay, on which the rough drift reposes at Sea Mill. Its surface dips seawards, and is eroded into grooves evidently by ice action.

A great deal of red sandstone débris exists in the clay, which rests on the Saint Bees sandstone, whose surface has been at some time exposed to the same denuding and grooving action. The flanks and head of the valley are comparatively clear of drift, if we except the Scalegill Valley, where there is an immense gut or gully filled with drift, between the red sandstone at Hole House and the carboniferous limestone at Shaw House, on the edge of Bigrigg Moor. If we allow this gut to have been filled subsequently to the moraine-like mounds at Sea Mill, we would have a clear and uninterrupted course for the wash or for the action of glaciers over the northern edge of the Cleator Moor coal field. This is the only explanation that seems plausible, and whereby we can account for Mussel Bed and other rocks in the drift found at Saint Bees.

I would invite some of my audience to examine for themselves the cliff on the edge of the Keekle river, near Moor Row Engine Works, and also the railway cutting at Scalegill, in confirmation of this theory.

This paper was illustrated by the aid of a model and sections of Saint Bees Valley, specimens of rocks from the drift, and organic remains from the vegetable matter.

THEORY AND PRACTICE, IN THEIR RELATION TO EACH OTHER.

By J. D. Kendall, W. H. Kitchin, and J. Nixon.

(Read at Whitehaven.)

Mr. J. D. KENDALL'S PAPER.

How frequently do we hear it said that a certain thing or operation is, or ought to be, so-and-so, according to theory, but that practically it is found to be something altogether different, as if the words theory and practice were the expressions of an incompatibility. That they are held to be such by many we know very well, but I think wrongly so held; in fact, I hope to be able to show in the course of these remarks that they are rather reciprocal parts of a unity—expressions of operations whose conjunction is essentially necessary for the useful and efficient effect of either of them. As, of course, the agreement or disagreement of theory and practice depend entirely upon the meaning which we attach to those words I shall, in the first place, state what that meaning is. In doing so I shall not trouble you with the definitions they received at the hands of the early Greeks, with whom they originated, and by whom they were contrasted and placed in opposition, but I will rather go at once to the meaning which they have at present. For however useful and interesting it may be to know the origin and history of a word, it is, in my opinion, much more useful to know its meaning now. A theory then may be said to be an explanation of natural phenomena, founded on facts, which are known to be true, from evidence independent of those phenomena

or appearances. The word is, however, like many of our other words, sometimes used in a very loose and indefinite sense, as, for instance, a man says, I have a theory that the heat of the sun is produced in such and such a way. Now, to me at least, it is quite clear that in so speaking he really means nothing more than that he has an opinion to that effect. Why he elects to dignify it with the name of a theory I cannot say, but so it is. Yet if the meaning of the word opinion be what I take it to be, that is, the uncertain judgment of the mind on any matter submitted to it, I think it must be clear to you all that, in the present state of science, the so-called theories of the sun's heat, as well as many other such theories, are really nothing more than opinions, which may be either right or wrong, as is the case with all opinions. If they are proved to be right, why they will be opinions no longer but facts; if they are proved to be wrong they will be at once rejected. Now, what do we know about the sun, with all our knowledge of it, to enable us to say with certainty, that its heat is produced either this way or that way? if but little, then our theories are only opinions with another name. The only definite sense in which the word theory is used, is where we say that the theory of a certain operation or result is so-and-so. For instance, we say that the theory of the ascension of a column of water in a tube that has been exhausted of air, is—first, that water presses equally in all directions; secondly, that action and reaction are equal; and, thirdly, that at the sea level water is everywhere overlaid by a stratum of air which exerts on it a pressure of nearly fifteen pounds per square inch. These three stages in the explanation are facts which have been established independently, and from them it follows that if the atmospheric pressure on the water be anywhere removed, as it would be under an exhausted tube, since action and reaction are equal, and water presses equally in all directions, then the surface of the water under the tube being relieved of downward pressure must rise in that tube until the weight of the ascending column is equal to the pressure of the air that has been removed. Now, every part of this explanation or theory is capable of demonstration, in other words can be shown to be a fact, and

therefore the whole of it is a fact. Whence follows the deduction, which to many may seem an anomaly, that a theory may be a fact, in short is a fact when the word is used in the definite sense in which I have now used it. Absurd as such a thing may seem, I nevertheless believe that the definition which leads to such an apparent anomaly is the true meaning of the word. Indeed, what other meaning are we to infer can be attached to it by those who put that most common question, "What is the theory of this?" It is not asked what is your theory of it or some one's else theory of it, but what is *the* theory of it. Now, in asking that question, what do they wish to know? Surely not that you think that the effect witnessed, which has led to the interrogation, *may* be the result of a certain cause, but that it *is* the result of some remote or mediate cause whose action you are able to point out. They wish to know the truth. In other words, they expect that your reply will be a fact. As to the meaning of the word practice when used conjunctively with theory, that is, in the sense in which I am now considering it, there is little difference of opinion; it being held to be the actual performance or carrying out of an operation.

With these definitions, let us now see what are the relations in which theory and practice stand towards each other. But let me remind you that I shall deal with theory in its definite sense, and not with that indefinite sense of it which is synonymous with opinion.

The great majority of our acts and operations may be divided into two parts—thinking and doing. The deciding how we are to do, and then the doing of it. Upon our decision as to the how mainly depends the result of our work. If we decide rightly, our work may be finished as we wish it; but if we decide wrongly, no amount of excellence in the manner of doing it will bring us to the desired result. It is clearly, therefore, of the greatest importance that before we commence to do, we should be right in our decision as to how we are to do. Our plan must be correct before we commence to carry it out. But how are we to know when it is correct? How, amid the manifold properties

of matter, the raw material with which we work, and amid the actions and interactions of what we call the physical forces, can we know what we are to do to arrive at any given result? Clearly but by the possession of a knowledge of those varied properties and actions. Now that knowledge, which is clearly so desirable, we call science, or when implying practice, theoretical knowledge—that is, the knowledge necessary to enable us to form theories or explanations of natural phenomena. We therefore arrive at the conclusion that to plan correctly we should be in possession of sound theoretical knowledge, or in other words—of a knowledge of those facts and abstract principles of nature which we call science. But planning is only one part of an operation. Our plans, to be useful, require carrying out, and for that purpose it is clear that we should possess a thorough knowledge of tools, of their use and application. Now that knowledge we call practice when we use the word in connection with theory, although it is sometimes used in that connection in the sense of experience, which is clearly wrong, because experience includes both thinking and doing, while practice has only reference to the latter. The relation in which theory and practice stand to each other—that is what we set out to find—is therefore that of planning and executing or thinking and doing, both of which operations are included in everyone of our works and actions that are not purely automatic.

Theory and practice are therefore, what I said before, reciprocal parts of a unity—expressions of operations whose conjunction is essentially necessary for the useful and efficient effect of either of them. For as thinking is useless unless it be carried out in action, so is theory useless without practice. And as doing without thinking may result in a great waste of time, material, and energy, so may practice without theory. Moreover, as doing without thinking resembles the action of a machine, so practice without theory could not possibly be progressive, but would repeat itself again and again. The arts would at once come to a standstill, and with them the whole moral and intellectual progress of man. Again, as we know of no doing that is not accompanied by some thinking, so there is no practice but is preceded by more or

less theory. And, further, as we know of much doing that follows inadequate thinking, so we see much practice that is the result of insufficient theory. But as that doing which is preceded by the greatest amount of thinking is most likely to be successful, so that practice which is accompanied by the greatest amount of theory will be most likely to attain the object it has in view, surely and economically.

From the definition which I have given of practice—as the carrying out of an operation—it follows that a practical man is one whose business is practice, that is, one who attends to the doing, but has nothing whatever to do with the thinking which is required in any operation. Yet the common usage of the phrase "practical man" implies that he is one that both thinks and does, who both plans and executes. But surely that is a mistake. For we have seen that before a man can plan correctly he must be a theorist, whereas we know very well that there are hundreds—nay thousands—of so-called practical men who know very little about theory. The really practical man, as that phrase is usually understood, is one who knows both theory and practice; who can think as well as do, plan as well as execute. As correct thinking and doing can never be antagonistic, so true theory and perfect practice must ever be in harmony. Whence then the alleged discrepancy between theory and practice? Here, either from mistaking that for a theory which is not a theory at all, or from the imperfection of practice. With the former we have nothing to do, but in reference to the latter we know that there has frequently been an apparent discrepancy between theory and practice, owing to the inability of practice to imitate at first trial the model that theory has set before it. But when such a thing does occur, practice should not hastily condemn theory, as it has too often done; it should rather remember that it is not itself pefect, and that therefore many improvements may be necessary in its methods before it can attain that special one to which theory points. It should not forget that but a few years ago the common operations of our machine tools were reckoned unattainable. They were then theoretical. They are now illustrations of the advantage which

practice reaps by following in the path of theory. Railways and all the ideas we associate with them existed a few years back but in theory, and the whole aggregate achievements of the steam-engine are but so much practice derived from the deductions of theory.

In conclusion, let me give you one or two examples of the absurdities into which so-called practical men may be led from a want of that theoretical knowledge which they affect so much to despise. The action of the siphon has often been a source of surprise to these so-called practical men. They have noticed that before that instrument can be made to act, it is necessary that the end from which the water is discharged should be at a lower level than that at which it enters. From that they have concluded that if the difference of level be sufficiently increased, water can be made to run over any height whatever. Such an assertion I have heard often by men of no mean so-called practical abilities. Yet a very small amount of theoretical knowledge would speedily convince them that increase the difference of level of the ends of the pipe as we may, the water will only rise to a certain height. After repeated, it may be expensive, failures they learn that truth. Yet that is what is commonly called practice, but what I call groping about in the dark. Again, it may be known to most of you, that on some pit cages there is fixed a contrivance for the purpose of preventing the fall of the cage should the rope break. A common form of the apparatus is for two pairs of levers or eccentrics to be fixed to the cage so as to be on opposite sides of each guide. These levers or eccentries are actuated by springs, which are connected with the rope that is used to raise and lower the cage. When the weight of the cage is *on* the rope, the action of the springs is taken off the eccentrics or levers; but immediately the weight of the cage is taken *off* the rope, as for instance when the rope breaks, then the springs act on the eccentrics or lever, causing them to grip the guides, and thereby stop the cage from falling. Now, I have seen a model of a cage and safety appartus of this sort prepared by a man who was considered by some people eminently practical, in which weights took the place of the springs

I have described for actuating the levers or eccentrics. Of course, the model could not be got to act as it was wanted, and no wonder, yet its maker could not see the reason why; but a very small amount of theoretical knowledge would have told him that when the cage was detached from the rope it would fall as fast as his weights, and therefore they could not by any means bring the lever or eccentrics into action. I might go on and give you scores of such examples as these, but time will not permit. I trust, however, that I have already said sufficient to show you that practice to be successful must be guided by theory. The two operations —mental and physical—must be united to secure complete and efficient action. Undoubtedly they have not been united to the extent they should have been, probably for the reason that good thinkers are not often good workers, and *vice versa*; but I believe that the day is not far distant when men professing to be practical men will guide their practice by theory.

MR. W. H. KITCHIN'S PAPER.

In the consideration of the relations between theory and practice, it is necessary in the first place to have a clear idea of the meaning conveyed by the terms, otherwise it will be impossible rightly to value the bearing which one has upon the other. Of the word *practice*, it is easy to conceive that the definition which occurs to every one will sufficiently cover and explain the term. It is understood to mean the working out of an operation which has previously been designed, or conduct which is guided by previously established rules. This view will in the main agree with that stated in the previous paper, and will suffice for the purpose of this discussion.

As regards the term "theory," considerable difficulty arises in making clear what it conveys. Under different conditions and relations the meanings which it bears may be widely separate.

The definitions which are usually attached to the word have been well stated as follows:—"(1) Speculation—a doctrine which terminates in speculation or contemplation without a view to practice. Here it is taken in an unfavourable sense as implying something visionary. (2) An exposition of the general principles of any science, as the theory of music. (3) The science distinguished from the art—for example, the theory of medicine as distinguished from the practice. (4) The philosophical explanation of phenomena, either physical or moral, as Lavoisier's theory of combustion, Smith's theory of moral sentiments."

Theory is distinguished from hypothesis, a word very often used synonymously, thus:—"A theory is founded on inferences *drawn from principles which have been established on independent evidence;* a hypothesis is a proposition assumed to account for certain phenomena, *which has no other evidence of truth than that it affords a satisfactory explanation of those phenomena.*"

Mr. Kendall seems to have somewhat mistaken the true meaning of the word. He makes the term *theory* to a great extent answer to *fact*, from which it appears to have a meaning entirely different. Theory is defined by him as follows:—"A theory then in physical science is an explanation of natural phenomena founded on facts known to be true, from evidence independent of those phenomena or appearances;" and he goes on to argue that a theory must be a fact, while he has in this definition affirmed that it is "an *explanation* founded on facts." If he had said, "a theory is an explanation founded on *inferences* drawn from facts established on independent evidence," no difficulty would arise in accepting the proposition, as it bears upon physical science; but it can hardly be assumed, for instance, that the explanation of the rise of a column of water in a tube from which the air has been exhausted is an "inference drawn from facts," it is rather a statement of facts themselves, and of their bearing one upon another. Each of the steps in the process is known and can be explained up to the highest point to which explanation is possible in the present state of knowledge. Not so with regard, for instance, to the atomic theory or the theory of gravitation. These are not and have not

been put to the actual test of fact. They remain "inferences deduced from facts," and which give a reasonable explanation of phenomena. Doubtless there is often a very close relation between theory and fact in physical science, and the former may be resolved into the latter, but a wide distinction must be drawn between the two when the former is treated of in its relation to practice. The bringing to bear upon everyday life of an accumulated knowledge of facts, is not the application of theory to practice; in this case, what has really passed from the stage of theory into fact, becomes utilised, and a man cannot be accounted a theorist because he employs his knowledge of facts as a guide in his conduct or that of others. Thus the application of the knowledge that a column of water will rise no higher in a tube than to the point at which it counterbalances the pressure of the atmosphere, no more makes a man a theorist, than does that which causes him to use a lever in moving a heavy weight; these acts are not done or directed on assumptions, they are based on experience and actual fact.

In the discussion of the proposition which forms the title of these essays, it will be well to adopt the broader view of theory which defines it as—"The philosophical explanation of phenomena either physical or moral;" and that of practice which may be taken as the application of the philosophical explanation to the rules of conduct, either physical or moral. These definitions are wider than those adopted by Mr. Kendall, but the subject under discussion should be treated in the broadest possible manner. Bearing these definitions clearly in mind, it will not be difficult to estimate the relation of one to the other, and the value which the one may have in guiding and directing the other. The very loose application of the word theory which has been touched upon in Mr. Kendall's paper is common enough, that is, its employment to signify a mere assertion of "opinion," and in contradistinction to practice as guided by opinion or judgment or independent of them. Thus it follows that the so-called theoretical man is often unfavourably contrasted with the so-called practical man, a position of matters which appears to arise mainly from a misconception of the terms and their application. A theory must needs be abandoned

if in practice it be found untenable—in other words, if on the application of a test it is found wanting. In the physical world no better illustration of a theory and of its practical application can be adduced than that set up by a fellow-Cumbrian, Dalton, and which remains till the present time unshaken as a "reasonable explanation of phenomena." The view propounded by Dalton was that matter exists in the form of atoms of different sizes which, when grouped together, unite in certain definite mathematical proportions, the proportions being always constant; that these atoms are the limits to which matter can be subdivided, and are so minute as to defy any examination. This theory, involving the three laws of chemical combination, is supported by facts which bear upon it indirectly. There is no direct evidence of its truth, as no one has ever seen an atom, and in point of fact their existence is purely theoretical. But what is the value of the theory? Briefly this—that the whole practice of modern chemistry has hinged upon it, and it remains the rule by which the operations of an important branch of science may be safely guided. Such a theory as this may be spoken of as established, yet it is but a theory, and may never in human experience be raised out of that position into one of actual fact. This may serve as an example of many other physical theories, which being reasonable explanations of phenomena, daily receive practical application, the laws which govern the physical operations and which are involved in the theory being brought into action. In such theories and their application, we see the relation which is pointed out by Mr. Kendall as that of *thinking and doing*, but which is yet a broader one than is quite conveyed to the mind by these terms. Such a relation is close enough, and in it we may admit the proposition that "theory and practice are reciprocal parts of a unity." Doubtless there is a class of theories which can never be practically applied, though their influence may be none the less great in directing us towards the solution of problems which may beset the mind. The ceaseless spirit of inquiry has in all ages led to the foundation of speculations as to the origin of the universe and its destiny. These speculations have through the more recent

advances of science become theories, and can fairly be propounded as such at the present time. The assertion may be doubted, but it will bear a close examination. Does not the nebular theory of the planetary system hold good as a reasonable explanation of phenomena, and is it not clearly supported by facts? This is evidently so, and though not established upon so purely mathematical a basis as Laplace's theory, that of Darwin holds no second position. Generalisation from facts is the basis of both theories, and they both become absorbed in that higher generalisation which points to the theory of evolution as that which may possibly in time become fully accepted as the most rational explanation, not of the causes of existence—ideas of these must remain purely speculative—but of the mode in which the universe became what we now see it to be.

In speaking of the philosophical explanation of moral phenomena, a field is opened up which could hardly have been intended to be entered upon when this discussion was instituted, yet it is difficult to treat of so wide a subject without some reference to this branch of it, probably the most important of all, as the conduct of life must to a very great extent be guided by theories of morality. These may be defined as rules of conduct deduced from experience, and from an estimate of the consequences of human action. As such every man may form his own theory as to what course of action will in practice tend towards the greatest good, either for the one or for the many. He is free to form his own judgment or to accept the theories propounded by others. The high moral tone adopted by many writers is based upon a theory of ethics which it is a lamentably rare thing to see practically applied. This is much to be deplored. The slight bond which appears to exist between theory and practice in the moral universe, contrasts very unfavourably with the relations they hold to each other in physics. A course of action guided by a theory of morals, that is, by a system which is laid down from deductions drawn from the results of conduct, ought to hold as close a position relatively to the theory which guides it, as does the practical working out of theory in the material world. In each case there

is a scheme or plan laid down, from which the best results may be expected; and on the extent to which the conduct or action is guided by the scheme or plan, depends the perfection or otherwise of the result. The conclusion arrived at must be that, viewed in the abstract, theory and practice bear the very closest relation to each other. Considered in reference to physics, their relation is close, and is constantly becoming closer; in morals it is capable of being much more intimate than at present seems to be the case. Physically only, and not morally, can we as yet accept the definition of theory and practice which postulates them as "thought and action," or as "reciprocal parts of a unity."

MR. J. NIXON'S PAPER.

It is a common assertion that all our great practical utilities existed at first in the state of theory. I quote this statement, because I wish to inform you that I shall confine my attention to the theory and practice implied in it, that is to the theory and practice meant by those who use the words in ordinary conversation, and discuss their relative value in the rise and progress of our arts and manufactures. Every department of practice has its special ends to be attained, and the means for attaining these ends finally resolves itself into knowledge. One of the ends of agriculture, for example, is to have good crops, and the means for attaining this end is a knowledge of certain implements with the mode of using them, and of certain manures to be applied; the end of navigation is sailing the seas, and the means for attaining this end is a knowledge of certain vessels which float in water, of contrivances for moving them through the water, and of various sciences for guiding them to their destination. Now, if knowledge be one extreme, and an end to be attained the other, somewhere between the two, theory and practice will be found. In solving the question it will be convenient to view it in three different aspects,—the first, where the means suggests the end; the second, where the end leads to the discovery of the means; and the third, where the end has been

successfully attained for some time by one means, and it is proposed to attain it more advantageously by a newly-discovered means. Very often the mere acquisition of knowledge suggests some useful purpose to which it may be applied. To improve upon Shakespeare, not in poetry, but in sentiment,—

> "How oft the sight of means to do *good* deeds,
> Makes good deeds done."

The knowledge of the motive power of steam, the knowledge that electricity can be transmitted through a long wire and act upon a magnetic needle at the end of it, and the knowledge of the inflammable properties of coal gas, are three most apposite, and altogether most extraordinary illustrations of this. In all the three cases it was in men's minds for a long time to apply the knowledge to the useful purposes of life, and each practical application in succession, as Mr. Kendall has already remarked with reference to the steam-engine and its off-shoots, existed for years in the state of theory; that is, though there was no doubt about the knowledge, as knowledge, there was a doubt whether, when applied to practical purposes, it would produce the desired ends. I need not say how fully all these ends have been realised.

The second aspect of theory and practice is that in which there is an urgent need for something—some end is very desirable, and men are prompted to search for the means. Now, which kind of men would most likely be successful in the search? The self-styled practical men, those mere mechanics, who just work by the light of a candle, which some have made and others have lighted for them, or rather men of high intellectual attainments in the subject matter, in other words—those who have a rich store of theoretical knowledge to draw upon? In the case of the former, the result would very probably be like Mr. Kendall's siphons and pit cages; with the latter, every condition, positive and negative, would be thoroughly investigated, and if the end were attainable at all in the state of knowledge at the time, the means would be brought to light. About sixty years ago there was a very pressing need for some contrivance to prevent the fearful loss of life by the explosions of fire damp, and practice showed its good sense by

making a special appeal to theory, for Davy was expressly sent in quest of the means, and, after much thinking and many careful experiments upon the gas and upon flame, he found it in the shape of these two items of knowledge: No mixture of gases will take fire below a certain temperature; and wire gauze conducts the heat away so rapidly as to keep it below this temperature. As long as the knowledge and the arrangements necessary to render it useful as a means to an end existed in Davy's mind, it was theory to himself; after his lamp was made and tested on a small scale, there were doubts for some time whether such a simple contrivance would be sufficient to meet the want generally; but now the theory is converted into a rule for practice. Again, in Newcomen's steam engine, at every stroke the steam was condensed by a jet of cold water; but this cooled the cylinder too, and of every five parts of steam which afterwards entered, nearly four were employed in raising the cylinder to the proper heat, and only one part did effective work in moving the piston. To prevent this waste of steam—that is waste of fuel—was a very desirable end, and Watt found the means one Sunday when he was taking a walk, in the shape of this item of knowledge—steam is an elastic fluid, which means in simple language, that if that room were air-tight, and full of steam, and if this room were air-tight, and contained nothing, except, perhaps, luminiferous ether, and if the door were opened, the steam in that room would stretch itself out until it filled both rooms. Not many minutes afterwards everything was sketched out in Watt's mind. He had a separate condenser connected with the cylinder; he saw the cylinder filled with steam, the condenser exhausted of its air, connection opened between the two, the steam rushing into the condenser to shrink into a drop of water, and the water which accumulated removed by the same pump as the air. When Mr. Kendall decided that the relation between theory and practice was that of thinking and doing, he must have had some example like this in his mind. It would be impossible to find in the history of mankind an instance where thinking, pure and simple, has resulted in so much doing. Well, Monday morning came, and Watt hastened to test his theory by experiment; before

night it was no longer a theory to him, but it was so for many years afterwards to the world, and why? Because he could not get cylinders made which did not leak, and pistons which were air-tight,—in short, because of the "inability of practice to imitate the model theory set before it."

The third aspect of the question is the one which has received most attention, by all except men of science. In this case, there are two rival means,—one known by experience to be sufficient for the end, the other as a rule discovered by the philosopher in his study, or the chemist in his laboratory, and shown by a process of reasoning to be capable of producing the end more efficaciously or more profitably than the old means. The successive steps are the same in all the three cases. First, there is knowledge, then a proposal to employ the knowledge as a means to an end—that is to apply it to some practical purpose,—and lastly, there is the active process towards the end. But in new cases there is always an element of uncertainty as to whether the end will be successfully attained, and, until this uncertainty is removed, the proposed means is generally known by the name of theory. In the two former aspects there is only one means to one end, and though there may be the same, if not greater, interests at stake, there is not, as a rule, the same antagonism of interests, and, consequently, not the same amount of discussion. When there are two means, it invariably happens that one is regarded as infallible; it is known from experience that it has only to be applied and the desired end will inevitably follow; the other is looked upon with suspicion, and the men who propose to apply it, and those who first actually apply it to the requirements of life, are by some called theorists. These so-called theorists may sometimes be too persistent in pushing a theory after it has had abundance of trial; or they may be too impatient, and throw up a theory before it has been sufficiently tried. There are examples of both kinds of men, and to such is due the disrepute into which theory has fallen; but without such theorists at all, practice would be stationary. And who are the practical men? Those who profess to be guided only by the experience they gain in the pursuit of their several branches of

industry. And what is this experience of theirs? A few years ago it possessed exactly the same attributes as that which they now designate theory, and it was gained, for the most part, from the practice of those whom they designate theorists. This may be shown by an example. The colouring properties of madder root have been long known, and when it was first proposed to apply this knowledge to the art of dyeing, there would doubtless be considerable uncertainty whether the scheme would turn out to be profitable. However, madder has been for many years extensively cultivated in many countries of Europe and Asia, and England has imported it to the value of a million of money annually. The transition from theory to practice is here well exemplified. About ten years ago, some one analysed the madder root, and found that the colouring principle was a substance which was produced by a kind of fermentation in the root, and which received the name of alizarine. Two German chemists analysed the alizarine, and found in it a substance called anthracene; this they recognised, and knew that it could be got from coal tar. Thus it was discovered that alizarine could be got from coal tar. That the colouring principle of the madder root can be manufactured from coal tar is merely an item of knowledge; but the knowledge, coupled with the proposal to use coal tar as a substitute for madder, is regarded as theory. There is no question as to whether the dye from one source is as effective as that from the other; the question is whether it would be profitable and expedient in every way to give up the cultivation of madder and use the artificial instead of the vegetable dye. This question remains to be answered.

Theory and experience are, therefore, not two distinct species, but the same in different stages of development. Thus far it seems that theory and practice are mutually implicated in all our industrial achievements. In estimating their relative value in the progress of nations, we are apt to confine our attention too exclusively to such men as Watt, Stephenson, Cooke, Wheatstone, Cyrus Field, or Holmes, who applied knowledge to useful purposes, and to leave out of the question those who created the knowledge so applied—men who have spent long years of hard labour in the

advancement of theory—who have worked for the pure love of science, without any idea of gain to themselves or benefit to the world at large—to whom it has rarely occurred that their labours would bear other fruit than the explanation of a phenomenon, or a separate existence and a name of its own to some substance. Galvani's mind was not engrossed with any immediate benefit he would confer upon mankind when he made his experiments upon the frog's limbs. He was only trying to settle a point in physiology. Whether he found what he was in quest of or not, does not matter, but he found something else. The limbs of the frog were hanging by a nerve from a metal support near an electric machine, and it was observed that the limbs twitched at every spark of the machine. Galvani could turn even this fact to a practical account, for he afterwards used frogs' limbs as electroscopes, and when so doing on one occasion, he observed the same twitchings as before, when the limbs and the metal attached to the nerve touched, at the same time, an iron railing. He explained this phenomenon by asserting that there was electricity in the limb itself. Volta maintained that the electricity was all owing to the contact of two different metals, and some one else attributed such phenomena to chemical action. Hence arose the two rival hypotheses usually called the contact theory and the chemical theory, and the sequel will show how, from mere hypothesis, a great deal of practice may spring, though indirectly.

These theories led to much discussion and investigation, and to new discoveries, amongst which may be mentioned Volta's pile, Davy's electric light, Oërsted's discovery of the action of electricity on the magnetic needle, and Faraday's specific inductive capacity and magneto-electricity.

"What have all these to do with theory and practice?" it may be asked. The answer is that these discoveries to which Galvani's experiment led are just like so many guide-posts, stretching their arms in many directions—pointing out the way to practical applications of service to the metallurgist, the photographer, and the sugar-refiner—leading up to the electric telegraph and the Atlantic cable —guiding men to the brilliant light which sends its beams far over

the sea, and, like a new star placed in the sky, keeps the mariner safe upon the great waters.

On the other hand, when knowledge has been successfully applied to practical purposes, the advance in every direction is so rapid—such gigantic strides are made that we ascribe everything to practice. In contemplating the majestic oak, the little acorn that was buried in the ground centuries before is forgotten. Knowledge is the seed; theory is the seed cast into the ground; practice is the growing plant, and the end is the ripened fruit. Some seeds never germinate; some theories only require trial to show that they are utterly incapable of producing the end aimed at. Some seeds spring up, but the young plant withers away; some theories assume a practical shape, but the counteracting causes cannot be eliminated, and the scheme is abandoned. Most seeds spring up and attain perfection; most knowledge, when applied to useful purposes, produces a rich crop of practical results. Theory without practice is nothing; and what is practice without theory? Perhaps a navigator sailing over the seas without sails or steam, without compass or chart—nay, without a ship; or else a husbandman living on the acorns and arbutes of the holy wood. To recapitulate, practice is the application of knowledge to the requirements of life; and, according to the general usage, theory is this knowledge at the stage where it has been proposed to apply it to some useful purpose, and before it has been proved to be sufficient as a means to an end. If a formal definition be required, it would be something like this :—In the business of everyday life, theory is an explanation of the way in which an end may be attained, the explanation being founded on knowledge acquired by scientific investigation, or by deduction from abstract laws, and not in the exercise of the art to which it is proposed to apply the knowledge. Upon comparison it will be seen that the difference between this definition and those given in the preceding papers is more apparent than real. Further, the end of knowledge, or theory—for theory is only a particular phase of knowledge—is practice, and practice is entirely dependent on knowledge or theory.

I do not altogether agree with Mr. Kitchin in one or two points. I think that the theory which implies practice must not be confounded with hypothesis; it is, in fact, much the same as general knowledge or science. Mr. Kitchin says that the bringing to bear upon everyday life an accumulated knowledge of facts is not the application of theory to practice. It is not the application of hypothesis to practice; it is the application of knowledge to practical purposes; and whenever knowledge is for the first time applied to the useful purposes of life, there is an element of uncertainty, not necessarily in the knowledge itself, but as to whether the desired result will follow its application. It is *assumed* that the desired result will follow its application. Before the uncertainty is removed the knowledge, coupled with the idea of making a practical use of it, has received the name of theory; after the uncertainty has been removed it is called experience, and is then utilised for practice.

I differ from Mr. Kitchin in reference to what he says about the atomic theory. It is not supported by facts: it is a mere hypothesis devised by Dalton to explain facts, and it is quite within the bounds of possibility that it may hereafter be supplanted by some other hypothesis which explains the facts better. I hardly think that the practice of chemistry is based upon the atomic theory as Mr. Kitchin has enunciated it, but rather upon the laws the theory is assumed to account for. These laws are four in number, and are called the laws of chemical combination. It would perhaps be well to explain briefly at least one of them. I will take that one called the law of multiple proportion. It asserts that, when one substance combines with another in several proportions, the higher are multiples of the lowest. Thus 10,000 ounces of nitrous oxide contain 6,364 ounces of nitrogen, and 3,636 ounces of oxygen; 10,000 ounces of nitric oxide contain 4,667 ounces of nitrogen and 5,333 ounces of oxygen. By reducing these numbers, we find that, in the former compound, the proportions of nitrogen and oxygen are 28 and 16; and in the latter the proportions are 28 and twice 16; and so with three other compounds of nitrogen and oxygen, the proportions are 28 and

three times 16; 28 and four times 16; and 28 and five times 16. The atomic theory assumes that the weight of the nitrogen atom is represented by the number 14, and that of the oxygen atom by 16; when combination takes place it must take place between whole atoms; two atoms of nitrogen, whose weight is represented by the number 28, unite with one of oxygen, weight 16, to form nitrous oxide, and with two of oxygen, weight 32, to form nitric oxide, and so on. Of course, this is all hypothesis; but the law of multiple proportion, and all the other laws of chemical combination, are facts. If they are not, it is either because there has never yet existed a trustworthy balance, or because a single accurate chemical analysis has never yet been made. The practice of chemistry is based on the facts, and not on the hypothesis which has been formed to explain the facts.

Mr. J. D. KENDALL'S REPLY.

That there would be an absolute agreement on all the points involved in such a discussion as this, none of us I think expected. Nor are we disappointed: for although we all arrive at the same conclusion, yet you cannot fail to have observed that, between Mr. Kitchin and myself, there are considerable differences by the way; differences, which, considering our ultimate agreement, it seems to me ought not to exist. In this reply—provided for in the arrangement of the discussion—I will, therefore, address myself to the consideration of those differences, with a view of showing how they have arisen. In the first place Mr. Kitchin objects to my definition of theory as an explanation of natural phenomena founded on *facts*, and suggests that it is rather an explanation founded on *inferences* drawn from facts. But surely that is a distinction without a difference. Can any one say that it is not a *fact* that the three angles of a triangle are equal to two right angles? But we know also that it is an *inference* drawn from facts. We see, therefore, that an inference may be a fact. In

this case it is a fact; and I unhesitatingly say that any inference which is not a fact, is utterly worthless as a foundation on which to build an explanation of natural phenomena, or indeed of anything else. What can the superstructure be worth if the foundation is not sound? and every inference that is not a logical inference must be unsound. But logical inferences drawn from facts we know are facts—facts about which we are as sure as we are of those with which we become acquainted through the instrumentality of the senses. Mr. Kitchin's definition, therefore, when reduced to simple terms, reads thus:—A theory is an explanation of natural phenomena founded on facts drawn from facts—which I think you will agree is only a roundabout way of putting the definition given by me. I should like you to bear this in mind, because it is the source of nearly all the differences that have arisen between Mr. Kitchin and myself in this discussion.

The next point of difference between us is where Mr. Kitchin says that it can hardly be assumed that the explanation of the rise of a column of water in a tube from which the air has been exhausted is an "inference drawn from facts," but that it is rather a statement of facts themselves. Now, whilst I agree with Mr Kitchin that it is a statement of facts, it is at the same time quite clear to me that it is also an inference drawn from facts. What is an inference? A deduction from premises. It is something therefore which is outside of observation. No man ever arrived at an inference through observation alone. Deduction is the business of the reason. We may observe the pressure of the air at the earth's surface. Or we may observe, under suitable conditions, the equality of action and reaction. Observation, too, may show us that water presses equally in all directions, and that it rises to a certain height in an exhausted tube, but it can never tell us why it so rises. The senses may say what *is*, but it is the intellect alone that can tell us *why* it is, when it is possible to satisfy the why. The rise of a column of water in an exhausted tube is not by any means self-evident. It requires explanation, and the way it is explained I have already stated. In that explanation we start with certain isolated facts as premises. From these, by a process

of deduction, we arrive at the conclusion that if a tube, the end of which is immersed in water, be exhausted of air, the water will rise in that tube to a certain height and no further. It will be clear to you all, I think, that that is an inference—an inference, too, drawn from facts—the premises with which we started. It is, moreover, an inference which, without the testimony of observation, we might have pronounced a fact. But observation also tells that it is a fact. The explanation therefore of the rise of a column of water in an exhausted tube, is not only a statement of facts themselves, but it is also an inference drawn from facts.

I next come upon a statement in Mr. Kitchin's paper to which I must object most strongly. It runs thus: "the bringing to bear upon everyday life of an accumulated knowledge of facts is not the application of theory to practice." To this I would reply that if the theory meant by Mr. Kitchin be anything less than an accumulation of facts, I for one would most certainly object to employ it as a guide to my practice, since I know that there is something—call it what you will—which I can safely employ as a guide. That something is the rational application of the body of accumulated and accumulating facts—both logical and observational—which goes by the name of science. That is what I call theory when I use the word in connection with practice, and I cannot possibly understand any one advocating the regulation of practice by theory, unless that be the meaning of the word.

A little further on in Mr. Kitchin's paper I find him saying "that the application of the knowledge that a column of water will rise no higher in a tube than to the point at which it counterbalances the pressure of the atmosphere, no more makes a man a theorist than does that which causes him to use a lever in moving a heavy weight." True, but Mr. Kitchin here fails to note a great distinction. One man may know but the simple fact that water will only rise to a certain height in an exhausted tube. Another man kows the fact quite as well, and in addition knows *why* it will only rise to that height. That is the man I call a theorist, and that, I think, you will agree, is the man most likely

to succeed in his practice, other things of course being the same. The former in using a siphon on the top of a high mountain would be misled by the knowledge he had gained by observation near the sea level. But the latter could not, because he would know theoretically that the higher he ascends above the level of the sea the less is the pressure of the air, and therefore the less will be the rise of a column of water in an exhausted tube.

Further on Mr. Kitchin remarks "that a theory must needs be abandoned if in practice it is found untenable." I should rather say so, if your practice is perfect before you abandon any theory.

I agree with Mr. Nixon in his criticism of Mr. Kitchin's remarks on the atomic theory—so called. The only value that I can see in the theory is that which attaches to every opinion—in which there is any appearance of truth—that it stimulates to further inquiry. To say that the whole practice of modern chemistry hinges upon it, seems to me like putting the cart before the horse.

From Mr. Kitchin's remarks on the nebular hypothesis and Darwin's theory of evolution—which he apparently sets on the same level of probability—he seems to make no distinction between hypothesis and theory, notwithstanding his definitions wherein he makes considerable difference between them. We know that Laplace, in his explanation of the planetary system, begins with a nebulous cloud—which he assumes—and out of that cloud evolves, in the most satisfactory manner, the whole planetary system. But given the planets as they are now, with their motions of rotation and translation, neither Laplace nor any of his followers have been able, by any process of deduction at present known, to arrive at the conclusion that those planets originally existed as a nebulous cloud. It is clear, therefore, that his explanation is founded on an assumption—the same as Dalton's atomic theory. Now, Darwin's theory is entirely different. It is foumded on facts. He begins with the facts that both plants and animals vary, and that there is constantly going on between them a struggle for existence. From these facts he infers, in the most logical manner, that species may be modified indefinitely. There is, therefore, this differnce betwee

the theory of Darwin and the hypothesis of Laplace, the former is an inference drawn from facts, the latter is an inference drawn from assumptions. The nebular hypothesis has had no more influence on the practice of astronomers, than the so-called atomic theory has had on the practice of chemists. But Darwin's theory of evolution has completely revolutionised the practice of Biologists, as did Newton's theory of gravitation revolutionise the practice of astronomers. The difference between theory and hypothesis is just as great as between fact and opinion, the latter may be true, the former we know is true. Never let us confound science with the opinions of scientific men.

A DAY AT ENNERDALE.

By Joseph Adair.

(Read at Whitehaven.)

A portion of this paper was read at the Society's excursion to Ennerdale in October last, under the title of "The Botany of Ennerdale." Since then it has been re-written, and although some facts touching on the botany of the district have been omitted, other paragraphs have been added so as to embrace in a narrative form what may be seen in a day's excursion. Most of the short notes which follow refer to the middle of August, that being the time when the lake and mountain district is seen to greatest advantage; for at that time the ling and heather are in bloom, and give the fine purple colour to the hills which adds so much to the beauty of the landscape.

Ennerdale is perhaps less visited by the tourist from a distance than most of the other lakes in Cumberland, owing chiefly to the difficulty of reaching it, and not from a lack of picturesque beauty, of which all admit it has a fair share, of the more rugged kind. It is, however, the place most accessible to our townsmen, and as such merits exploration by the geologist and botanist, as well as by the lover of fine scenery. Those acquainted with the district will observe a new and pleasing feature in the landscape as we approach within a mile or so of the lake. The piece of moorland known as Braemer, which was formerly a bleak and unproductive tract of land, is now covered by a thriving plantation, adding very much to the beauty of the place, and taking away in a great measure the appearance of barrenness which it previously had.

Ennerdale was no doubt at one time well timbered, and on seeing this vigorous young plantation of forest trees, one cannot help wishing that other owners of land in the district may emulate the example set by the owner of Braemer, and restore to the district its well-wooded hills. After passing Braemer wood we find ourselves in a green lane, rich in a variety of ferns and wild flowers, amongst which are the fox-glove and the hare-bell, intermixed with a variety of yellow and purple flowers. We may now stay for a while to examine one of the purple-flowered plants, which bears at the end of the stem a short spike of flowers, and below at regular intervals little clusters of like flowers. We may recognise it as betony. This plant was in old times in so much repute that a physician to one of the Roman Emperors wrote a volume in its praise. The herbalists of later date greatly esteemed it. Dr. Salmon, in his large folio, treats on the plant and its various preparations at great length, such as the liquid juice, the decoction, the oily tincture, the spirituous tincture, and so on, through thirteen different preparations, all of which (according to the writer's belief) have some value in alleviating or removing disease. It was supposed, however, to have a higher quality than that of a medicine to remove diseases of the body; for if it were hung up in a house it prevented the inmates from being bewitched. Even at the present day it is said there is a proverbial wish amongst the Italians to this effect, "May you have more virtue than betony."

Leaving for the present the further consideration of these virtues, let us take a few steps onwards towards How Hall. Near this farm we find the hop growing vigorously in the hedge by the roadside. It is a matter of dispute whether this plant is a native of this country or not. It grows in the south of England in a wild state, but the cultivated plant was no doubt introduced about the time of Henry the Eighth. For the old couplet says:—

> "Hops, Reformation, bays, and beer,
> Came into England all in one year."

The hop is closely allied botanically to the nettle, and bears the male flowers in loose panicles on one plant, and the female flowers in a catkin on a separate plant—these catkins being that part of the

plant used in brewing ale and beer. The hop is a very quick growing plant. A relative of mine had it covering his summer-house, and he observed that the usual length of growth of all the branches during the height of summer was about two or three inches in twenty-four hours, and that during the middle of the day the growth was equal in swiftness to the movement of the hour pointer on a watch, or about half an inch in three hours.

After passing How Hall, and descending the hill towards the boat house, we may find the elegant purple loosestrife growing in the hedge near the bottom of the hill. This species was referred to by Mr. Taylor in his lecture three weeks ago, when he pointed out that owing to the construction and nature of this plant it could not be fertilized if it were left to itself, and that it is necessary for the pollen of one flower to be carried to another (perhaps at some distance) by insects in order to secure (by means of cross fertilization) the production of seed.

On reaching the lake we see the gravelly bottom covered in many places with a green carpet formed by the leaves of the shore weed, intermixed with an odd looking plant, Lobelia Dortmanna, whose straight stem rises above the water, bearing sometimes a solitary flower or a couple of flowers resembling the campanula, or bell flower, to which it is closely allied. The leaves of this plant, as well as those of the shore-weed (both of which are generally under water), are hollow, having internally what appear to be water-tight compartments, which no doubt serve some purpose in the life and growth of the plant.

If we now for a short time take a walk to the right, by the side of the wood at the lake edge, we may, perhaps, get a glimpse of the meteor-like motions of a small bird darting up and down near the top branches of the trees, now on one side, now on another, and apparently never at rest. This is the golden-crested wren, the least of British birds (being only about the size of a walnut). Montagu says of this species, "It is the only native bird, I believe, which ever suspends its nest like so many of the tropical birds, for I have always found it hanging under the broad bough of a spruce, cedar, or yew tree; the thick flat disposition of the

leaves forming a sort of umbrella over the opening." For this information I am indebted to my sons, who have frequently seen the bird in this wood.

Returning to the left side of the lake we find on many parts of the boggy ground a peculiar-looking three-leaved plant, but at this season of the year without any flower. This is Menyanthes, a plant which Dr. Lindley says is reckoned one of the best of tonics. Were the time of year May, instead of August, we should see that it bore a flower, equal in beauty to many of the rarest exotics, and one which is hardly equalled by any other native plant. In similar kind of ground we find also the plant called sheeprot (supposed at one time to give that disease to sheep). It is noticeable as being the only British plant with a leaf like the garden nasturtium—that is, with the leaf stalk from the centre of the leaf. This plant belongs to the large order Umbelliferæ, but it is very unlike the other members of the order, such as the carrot, parsley, celery, and a host of similar plants, so much alike that in many cases it is difficult to identify them.

The most abundant species belonging to this order in the valley at this time of the year is the Burnet saxifrage, which has no particular virtue, unless it be that the root is said to have the desirable property of clearing the complexion. A very large proportion of the plants in this order are poisonous; fully one-fifth of those found in this country being either poisonous or hurtful to both man or other animals. Two of these grow in near proximity to each other a little from the lake, one being Ethusa, or fool's parsley, sometimes eaten with fatal effects for parsley; and the other hemlock, a well-known poison, the plant with which it is said Socrates was poisoned. In passing along by the lake side, or in the lanes, we cannot have overlooked a rather handsome-looking plant with a globular head of small purple flowers, which is abundant on every side, and now in full bloom. The story in connection with it is well known, but will bear repeating in the quaint language of one of the old botanists. The name of the plant is Devil's bit, and it has a stumpy root, as if the end were bitten off. The old writer says:—"Some have fabled that the

devil, envying the good which the herb might do to mankind, bit away part of the root, by which means it came to have the name of Devil's bit, but the fable is so ridiculous, that one which has but a grain of sense or reason, can never believe such a fiction."

In wandering along by the lanes and hedges, we meet with many plants that are not of frequent occurrence, amongst which are the Welsh Poppy and Hypericum calycinum, or large St. John's wort. Both of these are evidently escapes from cultivation, or garden plants, the St. John's wort being known as the Rose of Sharon. The white Corydalis, the small annual known as Teesdalia, the bird's foot, and the pretty eyebright, are all to be found in more or less abundance. The plant known as bird's foot has, when in seed, almost a perfect resemblance to the foot of a small bird. The old botanists seemed to have the idea that a plant indicated by its appearance or growth what its uses were, for instance, the plant named eyebright, from its likeness to the eye of an animal, was supposed to be good for removing films from the eye: "it strengthens the eye and optic nerves, helps a weak brain, and restores the sight being decayed." Culpepper says, "if it was as much used as neglected, it would half spoil the spectacle maker's trade." On the same grounds, the plantain with a leaf toothed something like the teeth of a dog, was considered a remedy for hydrophobia.

Leaving for the present many species of plants which claim our attention, let us return to the side of the lake again, and we may make an easy experiment to prove the truth or fallacy of the idea that most of our fresh-water fish change colour when they are swimming in a stream, and assume that of the bottom of the river in which they happen to be. Further, if they move from a light pebbly part of the river to a part where the bottom is dark, they will soon take a darker shade of colour, and become so nearly like the ground underneath as to be almost invisible.

At the entrance of one of the mountain becks flowing into the lake, we shall find a number of small streams of water, some with a clear pebbly bottom, others dark and mossy, and in all numbers of minnows are sporting about. Those that are swimming in the

clear streams are light-coloured, almost pearly in shade; and those in the stream with the dark bottom are equally as dark as the bottom of the stream they are in. We now take three or four minnows from the clear stream, and transfer them to the dark mossy stream. For a short time they seem uncomfortable, and swim rapidly about. Owing to their light colour their movements can be followed by the eye with ease. Very soon they become a shade darker in colour than they were when placed in the dark stream, and gradually assume, in a quarter of an hour or so, the same colour as the original denizens of the stream. If we now reverse the experiment, and remove the dark fish into the light, clear-coloured stream, we see that they for a short time dart swiftly about as before. The change comes quickly, however, and in a short time they become as clear and pearly in colour as those that they were placed amongst, and assimilate as nearly as possible to the colour of the clear pebbly bottom of the stream.

As we have still a good part of the day's work before us, let us return to the inn and take a boat across the lake to the Side wood, and as we shall not require the boatman for four or five hours, we may ask him to meet us at Smiddy Beck on our return. On landing, the lover of wild flowers will be gladdened by seeing an adundance of a rare plant growing freely along the edge of the lake. This will be recognized as Thalictrum flavum, meadow rue, an elegant species belonging to the same natural order as the buttercup. The rough rocky ground higher up supplies two uncommon species of ferns, known as the oak and beech ferns, both of which attain a good size, owing to the soil and situation being favourable to their growth. As we wander along through masses of ling and heather, we find everywhere the honey bee busy at work. A stranger might ask where do all the bees come from? Those acquainted with the district can soon answer the question. For the past fortnight or three weeks, the beekeepers from the lowlands have been busy bringing up their hives to the fells, for the bees to lay in a stock of the finest honey, which is obtained from the ling. The hives are scattered over the fells, on both sides of the lake, where the heather abounds, and being securely built in amongst

the rocks and stones, we may pass by numbers of them without seeing them, or having any idea of their being there. We now proceed by the side of the lake to its head, and then by the base of the mountain, and cross by a foot-bridge a considerable stream (coming down from the right) known by the name of Deep Gills. Following the stream about a quarter of a mile or so by the shepherd track leading up to the fells, we obtain a sight of a fine waterfall, which is quite hidden from view until we are a short distance from it. On returning, we obtain a very fine prospect of the head of the lake, backed by Bowness Knot and Latterbarrow, over which the higher fells of Herdhouse and Great Borne tower to a great height. On the left, the Side and Crag Fell; and on the right, Ling Mell and Starling Dod; in the middle distance the lake showing the entrance of the Lizza; and the foreground diversified by the mountain torrent of Deep Gills. We now return by the base of Ling Mell. At a short distance from the Lizza, we find the shepherd track which will guide us up the valley. After passing the two streams, known as Low Beck and High Beck, both of which are crossed by foot-bridges, and each with very fine waterfalls, we climb up on the right to the base of the Coves, about 1,200 feet or so. At this point the fells rise up on all sides before us, forming an amphitheatre of rocks of great extent and towering height, so that we might almost fancy we were treading in the crater of an extinct volcano.

Following the streams, we are sure to find that beautiful star-like plant, Saxifraga stellaris, and the rich orange-flowered species of the same family, growing in large tufts by the sides of the brooks. On the level part we have now attained, we may find (as I have been informed by Mr. Addison) the small willow, Salix herbacea, which, at its full growth, attains only the height of a few inches; and is consequently the least of British shrubs. It is properly an Alpine plant, flourishing only on the higher mountains.

We will now suppose that, so far from being tired, we are ready to ascend the Pillar Mountain, which, from this point, is only about an hour's climb. After climbing over a good deal of

rough ground in the ascent, we shall be rather suprised to find the top flat, smooth, and grassy, and sheep quietly browsing as if in a sheltered meadow. The view from the top is very fine and extended; Ennerdale, the lake, fields, and farms being mapped out beneath us. At this elevated point we find, in many places, the ground covered with silky-leaved plants, known as the Alpine ladies' mantle; and, like the least willow, only a denizen of the higher mountains. A little beyond the highest point of the mountain, which, by the way is over 2,900 feet above the sea, there is an easy descent, which leads us to the foot of the Pillar Rock; and no one can be said to have properly seen the Ennerdale Valley unless he has, to some extent, explored the precipices of this mountain, and stood at the foot of the Pillar Rock. This rock, which gives its name to the mountain, presents a striking figure as seen from the valley below; but it is only on near approach that we can see to full advantage its towering height and massiveness. On a fine calm day, we seldom hear any sound in this desolate region except the bleat of a sheep, or the scream of the buzzard as it circles high up in the air, with now and then the hoarse croak of the raven, whose nest is in some precpice of the mountain. The descent from the foot of the rock is over rather rough ground, but there is very little difficulty in reaching the bottom of the valley, nor much more so in crossing the Lizza, which, as seen from above, looks like a narrow silvery stream winding down the valley. Any one travelling down this inner valley, must have observed that a very great number of streams and springs fall into the Lizza from both sides. From this circumstance we may conjecture that the name Lizza comes from the Anglo-Saxon word, lisan, to gather; the Lizza being truly the gatherer of almost numberless streamlets from the mountains.

After passing the farm of Gillerthwaite, we ascend the hill of Latterbarrow, a few hundred feet in height, by an easy and gradual climb. Near to the top of the sloping ground, facing the east, we find here and there small heaps of stones, such as are very frequent in other parts of the Lake district. There is perhaps some kind of order in the arrangement, and it is assumed by

antiquaries that these heaps are the ruins of primitive dwellings, inhabited by a race of people now extinct in this part of the country, and whose remains are also to be found in the Highlands of Scotland and Wales. On the other hand, the sceptics say that the stones have been gathered together for the purpose of clearing the ground, so that the scythe of the mower might not be injured when cutting down the brackens. Others say that the stones are for the purpose of marking the burial places of these old inhabitants, and that the name Barrow, meaning mound or burial-place, was applied to this hill in consequence of this being the cemetery of the tribe. The answer to this is, that Barrow means also a wooded hill, the Latterbarrow the lower wooded hill, in contrast with the higher wood on the opposite side of the lake. This view is strengthened by the fact that the face of the hill next the lake is still covered with a growth of stunted trees.

On descending from the hill towards the stream known as Smiddy Beck, we traverse a long stretch of mossy ground, on which grows one of the most interesting class of plants that this country produces. The study of the carnivorous plants by Darwin and other observers has thrown a new light on the subject, and invested them with a new interest. Amongst these interesting plants the Sundew is the most abundant here, and is found in almost every piece of boggy ground, and at this season of the year one can seldom find a plant whose leaves are not disfigured by the remains of insects. It flowers at this season of the year, but the flowers are so seldom seen opened, that the enquiry has been made by experienced botanists, asking if the flowers ever do open. The answer is : The flowers (which bear a considerable resemblance to the garden saxifrage—London pride) expand in the forenoon of a fine sunny day, at other times they are closed ; consequently visitors looking for them on dark days, or even at any other time than the forenoon, would find the petals closely shut. The mode by which the leaves of this plant capture insects was so well explained in a lecture by one of our members a short time ago, that it need not be repeated. It will be fresh in the memory of most of our members.

Beside the Drosera or Sundew, we have also in the same kind of soil the Butterwort, which is a great insect destroyer, and effects its purpose by the same means as those employed by the Sundew. This plant is easily recognised by its bright green leaves, which spread out and form a rosette on the dark mossy ground. In spring it bears a pretty purple flower resembling the marsh violet, but at this season is destitute of both flower and flower-stem. The leaves of this plant, like the Sundew, are covered with glands which secrete an abundance of tenacious fluid. When a small fly or other insect touches this fluid it is instantly arrested and captured, and on one occasion I remember seeing a plant that was completely sprinkled over with captured insects. It was a plant of ten leaves, and on one leaf there were twenty insects, and as each leaf seemed equally covered with dead or captured flies, the total number of insects secured by this plant would be about two hundred.

On arriving at the lake edge again, we have the opportunity of examining another member of the carnivorous family of plants. One which captures its prey in a very peculiar manner, quite different to that by which the Sundew and Butterwort obtain their victims. The plant is found in the pools of water known as moss dubs, not far from where Smiddy Beck empties itself into the lake. It is rather an insignificant-looking plant, which is found floating in the water; the hair-like leaves forming tufts of foliage near the surface. On examination it will be found that these tufts have branches attached to them bearing something that are neither leaves nor flowers. They are something like bladders, and the plant gets its name, Bladderwort, from these appendages. It was supposed at one time that these bladders served quite a different purpose to that which it is proved by the investigations of Darwin and others they do serve. The idea was a very plausible one, and may perhaps still be partly true. The theory was as follows:—When the plant is very young it is found at the bottom of the pool. At this time it is said the bladders contain a kind of mucus, which prevents their floating, but as the plant requires more light and air, the mucus from the bladders is discharged, and the

bladders being filled with gas, buoy up the plant to the surface during the flowering season, after which the whole plant sinks to the bottom until the same thing is repeated in the following year. Darwin believes this to be a fallacy, and that the only purpose of the bladders is to capture minute animals which serve to nourish the plant, which according to this authority has no root, but floats loosely in the water. The bladders are furnished internally with glands. These glands do not discharge anything, but are for absorption. The entrance to the bladder is by a valve that opens inwards, and there is a collar against which it rests, and so prevents the valve opening outwardly, so that a small water flea or minute animal can push open the valve and enter, but having once entered, escape is impossible. Into this living trap the small animals force themselves, and as they can never escape they die in prison. The soft parts of the dead animal are then absorbed by the plant, and the hard insoluble parts rejected. On the few occasions on which I examined the bladders I found all tenanted, but the animals (one being in each bladder) seemed active and full of life. According to Darwin they might continue in that state until they died from want of air and food. Darwin says, with respect to the entrance into the bladders: "Animals enter the bladders by bending inwards the posterior free edge of the valve, which, from being highly elastic, shuts again instantly. As the edge is extremely thin and fits closely against the edge of the collar, both projecting into the bladder, it would evidently be very difficult for any animal to get out when once imprisoned, and apparently they never do escape. To show how closely the edge fits, I may mention that my son found a daphnia which had inserted one of its antennæ into the slit, and it was thus held fast during a whole day. On three or four occasions I have seen long narrow larvæ, both dead and alive, wedged between the corner of the valve and collar, with half their bodies within the bladder, and half out." Darwin felt much difficulty in understanding how such weak and minute animals could find their way into the bladders; but he found that a thin human hair, when cut short, could be made to enter, and that

although there is a considerable elasticity in the valve, it yields to a very gentle force properly applied. We are greatly indebted to the careful and exact investigations of Darwin in the science of botany. A mossy-looking plant in a half-stagnant pool is full of interest to him, and proves, on examination, to be a real curiosity in natural history.

Our ramble is now brought to a close. We have seen many things of interest; but not a tithe of what there is to be seen. The geologist might spend weeks in exploring the rocks, and in examining the different veins of iron, slate, and copper; some of which will no doubt, in the future, be fully explored and opened out. The botanist might also find in the exploration of the valleys, streams, and hills, work for many days, while the lover of scenery would delight in the never-ending change of the prospect —in cloud and sunshine—"ever changing ever new."

PETER CROSTHWAITE,

The Founder of Crosthwaite's Museum, Keswick.

By J. Fisher Crosthwaite.

(Read at Keswick.)

Peter Crosthwaite was the third son of Robert Crosthwaite, of Monk's Hall. He was born at Dale Head, in the parish of Crosthwaite, and was baptized at the Parish Church on the 22nd of September, 1735. His father learnt farming with Mr. Bell, of Goose Well, who was farm-bailiff for the forfeited Derwentwater Estates. He took the Dale Head farm, belonging to the ancient family of Leathes, who came thither from Leathes, in this county, in the reign of Queen Elizabeth. From this place he removed to Monk's Hall, where he continued to reside till his decease, at the age of eighty-five years, in the year 1787. His descendants have resided there ever since, except for one short lease. Peter Crosthwaite probably received his education at the Crosthwaite High School. When he left school, the only means of putting young men forward in the neighbourhood were farming, a mechanical trade, or the woollen manufacture. In many of the hamlets, farming and weaving went on together. Most of the farmers and yeomen brought up their sons either to farming or the woollen trade; but some went off to large towns, where they frequently succeeded well. Now and then a more opulent yeoman sent a son to Oxford, as was the case with Sir John Bankes. The subject of this notice was sent to Brownbeck, in Naddle, (a farm which belonged to his father,) to learn weaving with John Howe, who was then the tenant. The employment was monotonous and

sedentary, and did not suit the health nor the inclination of Peter Crosthwaite. Nevertheless, he faithfully served his apprenticeship.

A sea voyage having been recommended to counteract the effects of long hours in an ill-ventilated workshop, he elected, with his father's consent, to go to sea, and to follow a sea-faring life. Governor Stephenson went from Keswick to the East Indies in 1707. He returned twenty years after, and resided at home for forty years. He built the house in Keswick called Governor's House. Possibly such an example of prosperity in the East may have given an additional impulse to a youth anxious to see the world, and turned his thoughts to India. He went for twelve months to learn navigation, and at the age of twenty-two, having letters of recommendation from Mr. Stephenson, he sailed from Gravesend in April, and from Spithead in May, 1758. After a voyage of nine months he reached Bombay. He was at once engaged in the East India Company's service. After serving eight months before the mast, he was appointed master of the Gallivat "Otter," a gun vessel used by the East India Company to convoy their ships while trading, and to drive off the Malay pirates. In the ordinary course, seven, and sometimes even nine years, had to be spent in the service before such a post could be obtained. He was equal to the situation, and had the credit of discharging his perilous duty with great zeal and ability. The "Grab Service," as it used to be called, has become the "Indian Navy," and it now opens a noble field to English seamen. Captain Thomas Fletcher, who went from Myrtle Grove, has recently retired with a good service pension; and Captain John Howe, who went from Harryman Field, is now the oldest officer remaining in that service. The rapid promotion of Peter Crosthwaite provoked the enmity of those of the same rank, and of one or two immediately above him. The friend to whom Governor Stephenson had recommended him died, and on that event occurring, he was subjected to a series of annoyances which, to his sensitive nature, were intolerable. He bore up for some years, but ultimately, his health giving way under the mortifications he endured, he determined to quit India and

return to England. The papers relative to this period are still in existence, and I am satisfied that if his lot had fallen in our own times, his Indian experience would have been far different. He arrived at Gravesend in November, 1765, no richer than when he went out, and with an arrear of pay still owing to him by the Company.

He was now thirty-one years of age, having been nearly nine years away. In London he casually met with a former neighbour, Miss Hannah Fisher, of Shaw Bank. She was the daughter of Mr. Daniel Fisher of that place, and a descendant of that stout yeoman, John Fisher, who fought the eight years' legal battle with the first Earl of Derwentwater, relative to the "Town Cass," and "prevailed." She was a girl in her teens when Peter Crosthwaite finished his apprenticeship at Brown Beck. Whether it was love at first sight, or the re-kindling of a former friendship, I know not; but certain it is that they engaged to marry as soon as he settled in any new employment. Her brother, Mr. Timothy Fisher, of Holborn Bridge, became King's Linen Draper, and she had been engaged keeping his house. It was not long before Crosthwaite obtained a situation in the Customs at Blyth, in Northumberland, and to this place he took his young wife. The village of Blyth then contained about one hundred and thirty families. It is still, I am told, about as unprepossessing a place as could well be imagined. The preventive service was always laborious and dangerous, and Blyth Nook was one of the spots where smugglers followed their contraband work with great boldness. Many a time during the twelve years he was engaged in the service was he fired upon. But he was zealous in the performance of his duty, holding it to be "undeniable that those people who in anywise encourage smuggling are disloyal, traitors to the State, and enemies to civil society." The incessant night duty at length told upon his health, and his friends urged him to retire. His wife joining in their entreaties, he at length decided to do so. As an additional inducement, his father gave him the small estate where he served his time. He procured the superannuation to which he had subscribed, and entered upon his "Castle" (as he called it)

at Brown-Beck with his wife, son, and daughter, in the year 1779.

No doubt the changes which had taken place in the twenty years which had elapsed, would force themselves upon his notice. No longer the old Lonnings like "Castle" and "Cuddy" Lonnings for a King's highway, but a new turnpike road, made under an Act of Parliament passed in 1760. The Derwentwater Estates had been covered with majestic oaks. Every one of them had fallen beneath the woodman's axe, leaving Crow-Park, Strand's Hagg, Deer-Close, and Water-house Banks, with only the young trees which have been allowed to spring up from the roots of the ancient forest trees. For twelve months only he rested at Brown-Beck. No doubt he thoroughly enjoyed that year. His son, then only four years old, well remembered in after life how his father took the family out on a Sunday morning to one of his fields, called "The Hills," to listen to the ringing of the Crosthwaite Church bells, before going to St. John's Chapel. The little estate was too small a holding. He let it, and took a house in the Square at Keswick in 1780, and at once commenced his Museum.

It required the man to have some confidence in his own foresight to think of establishing a Museum for tourists, who were only just then beginning to visit the Lakes. It was but seven years before that Hutchinson had published his "Excursion," and Gray, the poet, his "Journal." But he saw that the Lake District only required to be made known to become the holiday place of the many, as the Continent had been for the few. Keswick had then only 1078 inhabitants, with one main street seven hundred yards in length. The first step which he took to increase the number of tourists was to publish maps of the Lakes :—Derwent, Windermere, Ullswater, Coniston, and also of Pocklington's Island; to which he subsequently added Bassenthwaite, and on another sheet, Buttermere, Crummock, and Loweswater. These accurate drawings, with neat vignettes, soundings, West's fine stations, and others of the author's own choice, met with an extraordinary sale, enabling him to enlarge his museum, which now became the treasure and solace of his life. He notes ordering 3370 sheets in 1786, aud 4450 in 1789. The Museum House (as we still call it)

was built in 1784. He entered upon it as soon as it was finished, and the Museum continued to be exhibited till 1870.

The year before he commenced it he succeeded in recovering the pay that was due to him from the East India Company. He had never ceased to call at the India House, but for nineteen years he was denied a hearing, so unwilling were the directors to hear anything amiss of their servants abroad. But now, Sir Joseph Pennington, of Muncaster Castle (the first Lord Muncaster) was chairman, and Sir Henry Fletcher, M.P. for Cumberland, a director. The case was referred to a committee, of which Sir Henry Fletcher was one, and he received the £60 pay due to him. This act of tardy justice gratified him far beyond its intrinsic value. He was always a staunch Whig, and no doubt he had great pleasure in writing to Sir Henry Fletcher next year, that he hoped he would be returned M.P. for Cumberland without opposition, but if there was a contest he might depend on his attendance at Cockermouth on the polling day, and three or four more in his interest.

In 1785—June 10th, he enters in his journal:—"Soon this morning found six musical stones at the end of Long Tongue," on the sandbeds of the river Greta. He afterwards mentions, that while the first six of the collection he formed were in perfect tune, the remaining ten cost him half a year to collect and reduce, by chipping, into perfect tune, working twelve hours a day. It has been the ill-fortune of Peter Crosthwaite to lose whatever credit may be due to this and other discoveries. When a party from Keswick travelled with a set of five octaves, and played in the presence of Royalty, the merit of the discovery was given by the press, and *claimed by the chief of the party*, as due to him. Mrs. Southey (Caroline Bowles) wrote, requesting that I would contradict the statement in the London newspapers, as she had done in a public room where they were exhibiting. I did not think it worth while, but when the same statement was made in Keswick, by advertisement, I did think it right to point out that the History of Cumberland mentioned the set in Crosthwaite's Museum many years before the collector of the new set was born. A Whitehaven

paper put in an excuse for refusing my letter, and the *Carlisle Journal* only admitted it as an advertisement. In the *Leisure Hour* for August, 1857, was the following passage:—"The Æolian Harp was first invented, or rather discovered in Keswick, by old Peter Crosthwaite, the founder of the Museum. Peter had a fine ear for Nature's harmonies; and not only did he tune the wild harpings of the mountain winds, but while listening to the wail of the Greta, he learned that its very stones were melodious. And so he gathered now one, and then another, from its rocky bed, and, striking them, his thrilling ear caught the regular rise of one note above another. In this way he formed two octaves, and laid up in his beloved museum the first set of "Musical Stones" which perhaps were ever arranged in England."

In 1786, Mr. Crosthwaite made a zig-zag road up the front of Latrigg, for the convenience of tourists and the public. He began the road on the 14th of November, and continued to work upon it till it was completed, sometimes working as much as nine hours a day. In his Journal, February 25th, 1786, he says, "Took Mary, and surveyed from the foot of new road to the head of the first *stairs*, and beat off work by east wind, proceeded to top of Latrigg and Catgill—then dined in the Rocky Alcove, and inspected Skiddaw road, from thence to Spoona-green and the old Casten-up works on the hill above Birkett Wood, where there are many and large on its side, next to Skiddaw in particular." Four years later he records himself and son having wrought upon the same road, and that Robin Lancaster, aged eighty-six years, walked to the top of Latrigg with ease, and told old stories all the way up and down again. "Afterwards Daniel and I made eighteen yards of new road leading from the middle of Spoona-green Head to the first tack, and set the water-course right, which Andrew had again put wrong." In June following, he mentions John Jackson, late of Stenwick, aged eighty-seven years, and old Thomas Ladyman, aged eighty-five years, having accompanied himself and Mr. Allinson to the top of Latrigg. This was all before the Brundholme enclosure took place, after which Latrigg was ploughed, and the foot-way of course disappeared. About this time he says,

"Sent three men to build up first beacon on Skiddaw—Henry Powlay, Isaac Williamson, and — Dunglinson, which they did, and drove in two posts with rings to fasten horses to, but by September the same year both posts were gone."

The sham battle which came off annually at the Keswick regatta, was depicted by Smirke, and published as a coloured print at the cost of a guinea. The affair was thus described in Hutchinson's History of Cumberland:—"About three o'clock preparations were made for the sham attack on Pocklington's Island. The fleet (consisting of several barges, armed with small cannon and muskets) retired out of view, behind Friar's Crag, to prepare for action: previous to which a flag of truce was sent to the governor, with a summons to surrender upon honourable terms. A defiance was returned; soon after which the fleet was seen advancing with great spirit before the batteries, and instantly formed a curved line. A terrible cannonading began on both sides, accompanied with a dreadful discharge of musketry. This continued for some time, and being echoed from hill to hill in an amazing variety of sounds, filled the air with whatever could produce astonishment and awe. All nature seemed to be in an uproar; which impressed on the awakened imagination the most lively ideas of the "war of elements" and "crash of worlds." After a severe conflict the enemies were driven from the attack in great disorder. A *feu-de-joie* was then fired from the port, and oft repeated by responsive echoes. The fleet, after a little delay, formed again; and practising a variety of beautiful manœuvres, renewed the attack. Uproar again sprung up, and the deep-toned echoes of the mountains again joined in solemn chorus; which was heard at a distance of ten leagues to leeward through the easterly opening of that vast amphitheatre as far as Appleby. The garrison at last capitulated, and the entertainment of the water being finished, the company moved to Keswick, to which place from the water's edge, a range of lamps were fixed very happily disposed, and a number of fireworks displayed off." Whatever may now be thought of this diversion, it is certain that it drew together the nobility and gentry from the adjacent counties.

It was not merely the whim of Colonel Pocklington, the defender of the island, aided by Peter Crosthwaite as admiral of the fleet, but the stewards for the ten years it was continued, were the leading noblemen and gentlemen of the county, as will be seen by the following list :—

1781—Joseph Pocklington, Esq.
1782—Rowland Stephenson, Esq.
1783—Edward Stephenson, Esq.
1784—Sir Michael le Fleming, Bart.
1785—William Dacre, Esq.
1786—The Earl of Surrey.
1787—Joseph Pocklington, Esq.
1788—Sir Henry Fletcher, Bart.
1789—Wilfred Lawson, Esq.
1790 { Henry Howard, Esq., of Corby ; and
Thomas Wallace, Esq., of Carlton Hall.

In 1786 a poem was written on this topic, which is given in Hutchinson's History.

In 1788 Mr. Crosthwaite commenced his correspondence with Dr. Dalton. In 1793 Dr. Dalton published his first work, "Meteorological Observations," in which the observations made by himself at Kendal, are compared with those made by Mr. Crosthwaite at Keswick, over a period of five years. The Barometer, Thermometer, Rain-gauge, Height of Clouds, Winds, Snow, Aurora Borealis, and a variety of other phenomena were duly registered. Dr. Dalton remarks, that Mr. Crosthwaite's table recording 5,381 observations taken over a period of five years, on the height of clouds, is the only one of the kind extant.

In 1794, Lord William Gordon was settled in his new house at Water End. He bought up all the land on the western shore of Derwentwater, and planted it with great taste. Before this, there was no wood on that side of the lake, except one large tree. Lord William was very popular with all classes. He invited his neighbours to join him in hunting, and entertained them to dinner afterwards. In his Journal, Mr. Crosthwaite mentions three

occasions when he was present, and on another occasion when Dr. Norman and he were the only guests.

While measuring Scale Force, in 1796, he mentions giving Mr. Robinson, the host at Buttermere, half-a-crown to encourage him to make steps up the Black Rock, to aid tourists in visiting the fall.

During his residence at Blyth he invented a life boat, for which he thought of taking out a patent. He consulted a ship builder at Shields, who said that ninety-nine out of every hundred patents did not pay. He took his model of the invention to the Admirality, and was requested to leave it there for consideration. Meanwhile, a boat builder at Shields in the employ of the ship builder previously consulted, brought out a life boat lined with cork, which was the new principle Peter Crosthwaite applied, and which he had not hesitated to mention to the ship builder in consultation. Whether the latter communicated the idea to his boat builder or nôt, can now only be a matter for conjecture, but it is quite certain that Peter Crosthwaite's model was deposited at the Admirality some years before Mr. Greathead's was sent in. The Government awarded Mr. Greathead £1200 for his invention.

In the year 1800, he published a pamphlet, and issued one hundred copies, relating to the settling of Derwent Lake twelve inches, in addition to nine inches which his brother had already lowered it. This would have brought one hundred and thirty-six acres into cultivation. On this topic his diary has the following entry :—"March 31st, 1801. At this time I received the thanks of two philosophers for writing my small pamphlet on the draining of Derwent one foot, and thereby mending the relaxing air and rendering the coast of Derwent better for individuals. Their names were Coleridge and Wordsworth—both poets too."

Meanwhile, the Museum increased year by year. His extraordinary zeal in collecting, and the liberal prices he paid, brought everything that was curious from all parts of the county. The time would fail me to tell the excursions he made on the mountains to examine their geological formation. The papers he has left behind are so numerous and varied, that, although

I have spent all my spare hours amongst them for the last two or three weeks, I am only able to give a scrap here and there. Mr. Otley told me the secret of all this industry. He said, "I early adopted your grandfather's habit, of never indulging in a second sleep, and I continued it with the best results till extreme old age caused me to indulge in a second nap." Mr. Crosthwaite often commenced his journal at three, four, or five o'clock in the morning, and consequently he had frequently done a deal of work before most people were astir. But, Peter wrote a book. "O! that mine adversary had written a book!" said the patriarch Job. I do not know whether friends or foes knew much about it; but, during the twelve years he was at Blyth, he made health a study. In the year 1775, he published a work of 215 pages, entitled "The Ensign of Peace," "showing how the health both of body and mind, may be preserved, and even revived by the mild and attennuating power of a most valuable and cheap medicine. Its singular and most excellent property is to subdue the flesh to the will of the spirit, by which means mankind may enjoy a state of temperance instead of intemperance, and a state of virtue instead of vice. The continued use of this *medicine* eradicates most diseases, and is seriously recommended to the people of this island. By a Friendly Traveller. London: printed for J. Wilkie, No. 71, St. Paul's Church Yard, 1775."

Five hundred copies were struck off at Newcastle-on-Tyne. After going into the whole subject of temperance, exercise of the passions, sleep, intemperance, lust, tyranny, war, duelling, pride, revenge, ingratitude, quarrels, gaming, injustice, justice, faith, vice, virtue, and magnanimity, he recommends his medicine in the following words:—"The name of this medicine which I am about to recommend the world is *Water*, and the purer the better. It is to be applied externally and internally to the body. The external application is by washing every part of the surface of the body with it, from the crown of the head to the soles of the feet, in its natural state in the warmth of summer, but in high latitudes in autumn, winter, and spring, its cold may be so far removed by the action of fire as not to make it too disagreeable when it comes in

contact with the skin. And this salubrious method of washing I would recommend to all ranks of the people, from an infant to the exit of the gray-headed, making allowance for the few infirmities which cold bathing is against, in the greatest heats of summer." He quotes various authorities in favour of the use of soft water, amongst others, Dr. Rotherham, who says—"the water in some of our lakes in this island is, I apprehend, as pure and good as we shall find elsewhere. I pretend not indeed to have analysed many of them, nor even to have tried their specific gravity, but I remember well to have drunk of the waters of Winander-mere, Ulls-water, and others of our large lakes of Westmorland and Cumberland, and have found them very soft and good." Mr. Crosthwaite continues, "There are many lakes in Cumberland which the Doctor hath not named, particularly three, which are situated about three miles from each other, extending in a right line from south-west to north-west, and are known by the names of Wythburn-water, Derwentwater, and Bassenthwaite-water. Wythburn-water is the least, and in compass nearly one square mile; Derwent is situate in that delightful and much admired valley in which Keswick stands. They all receive and emit running waters, and that perhaps on the average, at the rate of their whole contents in the space of a month in the summer season." These opinions were published one hundred and two years ago, and seem to indicate that the writer looked forward to the adoption of soft water for domestic purposes. When he settled in Keswick he had a well sunk at High Hill, and a pump placed there. It stood at the corner of Crosthwaite Sunday School. The water was filtered through a gravel bed from the river, and was remarkably soft and pure. Many persons derived benefit from the use of it, and the last entry in his journal, mentions that he had sent to Mr. Pocklington an account of its valuable properties. Southey, in a letter to Mr. Grosvenor Bedford, thus playfully alludes to this pump: he says, "I have discovered most poignant and good galvanism in drinking water out of an iron cup—how far this may improve fermented liquors remains to be experimented; the next time you see a pump with an iron ladle thereunto appended, stop,

though it be on Cornhill, and try." He notices it a second time just after Mr. Crosthwaite's death. I forget the occasion—but he called it "poor old Peter Crosthwaite's pump." For very many years people from the town went to High Hill for water in preference to the wells close at hand, which were contaminated by noxious matter. To return again for a moment to his book. Here we have a man, a hydropathist before his time. His recommendation of the use of water is the key note of the work, and I just quote the remarks on the last page, which will show the spirit in which the writer propounded his theory. In conclusion he says, "Barter with Jews and Gentiles. Give and take. Give pure religion, and receive their cleanly and salutary customs. Teach them without superstition the gospel of Christ, in its greatest purity, and learn from them (it was from them I received it) how to make the best use of pure water. Draw near to them in a cleanly and temperate manner, and they will draw near to you; and let us, in the name of God, be one fold under one great shepherd. Then shall the wolf dwell with the lamb; and the leopard lie down with the kid; and the calf and the young lion and the fatling together: and a little child shall lead them." And then, may "the earth be full of the knowledge of the Lord as the waters cover the sea."

It is not every one who has been in India who has faith to believe in the conversion of the heathen. But here is a man who advocated Christian Missions, just a quarter of a century before the Church Missionary Society for Africa and the East was established.

In 1798, when canals were being constructed in other places, Mr. Curwen, M.P., and other country gentlemen, mooted the question whether one from Skinburness to Keswick could not be made, passing along the shore of Bassenthwaite Lake. Mr. Crosthwaite took five or six days to level from the sea to Dunmail Raise at his own cost, and he reported that the number of locks necessary would make the work so expensive, that it would not pay for the outlay, and consequently the idea was abandoned. For eight and twenty years he carried on his Museum, and in his

will provided that it should never be disposed of, except altogether. For sixty-two years longer his son, and his family carried it on, making a total of ninety years. Every effort was made to dispose of it in its entirety, but without success. For seven years this was done. It was offered to the County first, next to the British Museum, and then to the principal large towns. Sir Ashton Lever disposed of his large Museum by lottery, but the person who won it sold the collection a few years after, so that the plan held out no encouragement for keeping the collection together. Its dispersion being inevitable, it was determined that the sale should be at Keswick. Not that the best prices were expected in so remote a place, but it gave the opportunity to those who cared for such things to possess themselves of anything they liked in connection with the neighbourhood.

It would ill become me to attempt any eulogium on a person so nearly related as a grandfather. I have placed before you a few facts, and I leave you to pass your own judgment. I may, however, claim for him a foremost place as a pioneer, in opening out and making known the Lake District. His exertions in this direction were not undertaken in any mercenary spirit, but for the public good. He died of apoplexy after a few hours illness, on the 9th of June, 1808, and some friendly hand put on his tomb the words :—

"AFTER MANY DANGERS, I HAVE FOUND A PORT."

In Ware's *Cumberland Advertizer* (now the *Cumberland Pacquet*) the following obituary notice appeared :—"On Thursday last, at Keswick, in the 73rd year of his age, (after experiencing for eighteen months past better health than he had enjoyed for twenty years before,) Mr. Peter Crosthwaite, the establisher and proprietor of the celebrated Museum at that place—a depository of curious articles, so universally known to the nobility and gentry of the United Kingdom as of itself to afford the best eulogium on the zeal, discrimination, and indefatigable assiduity of its projector, to whose persevering spirit the public are indebted for an extensive and interesting collection of rare productions, both of nature and

art, from every known part of the world. Mr. Crosthwaite opened the Museum in his native place, in the year 1780, some time after his declining health had rendered it necessary for him to quit the service of the East India Company. He lived respected by his neighbours, and few men in this or any other country had so numerous an acquaintance."

SYMBOLISM IN ART.*

By J. A. Wheatley.

(Read at Cockermouth.)

The subject of Symbolism is one of absorbing interest; it enchains the attention of the student of History and Theology as much as that of the artist, perhaps more, because in its primitive forms, when it is most interesting and instructive, it has little, if any claim to the title of Art at all; and even in its culminating epochs, it is remarkable more for manipulative skill than artistic genius, and appeals to the intellectual and imaginative faculties in a manner very different from, and in a degree far inferior to, the sublime conceptions of Greek and Roman Art. In what then consists its great importance, its powerful interest, its mysterious charm? To answer in some degree these questions is the object of this lecture, and I will endeavour to deal with it in a loving and reverent spirit.

In the first place then, to trace the history of Symbolism, we must go back to the very earliest authentic records of the history of the human race. It pervades, almost absorbs, what we know of the earliest historic races of man; and would it not be wonderful if it were otherwise? Let us for a moment glance at the faculty of man to which Symbolism first appeals—the sense of *Sight*—the first of the gifts of the Almighty; the first agency by which the powers of the intellect are awakened; through which his mental faculties are called into being, and trained for good or ill. Through the sense of sight the brain is reached, the heart is touched, the imagination is aroused. Effects are instantaneously

* This Lecture was profusely illustrated.

achieved which, by the slower sense of hearing, require time, patience, and laborious effort.

Sight, too, is a universal language; so that we find in every primitive race the principles of Symbolism practised and understood. Where intellect exists, the sense of sight enables man to attach a meaning to the forms of objects, animate and inanimate, around him. This is amply illustrated by the pictures of Indian life sketched by many illustrious writers. The Mohawk brave, who stands before you in his war paint, and bears on his swarthy breast, indelibly tatooed, the representation of a grisly bear, a rattle snake, or a beaver, proclaims in language that all who run may read, that he is a formidable and powerful enemy, a secret and dangerous foe, or a wise and illustrious chief. Here then is the origin of Symbolic Art; nor is it less conspicuous in his squaw who, even in name, symbols her qualities, good or bad: her fierce and angry passions, her patient and yielding temper, or her thrifty and careful love. Need I remind the readers of Longfellow of the charming picture which he gives in his poem of "Hiawatha," of the old arrow maker's child.

> "With him dwelt his dark-eyed daughter,
> Wayward as the Minnehaha,
> With her moods of shade and sunshine:
> Eyes that smiled and frowned alternate;
> Feet as rapid as the river;
> Tresses flowing like the water,
> And as musical as laughter—
> And he named her from the river—
> From the waterfall he named her
> Minnehaha—laughing water."

Nor is it only in the Indian's name and effigy that Symbolism is apparent, it exists in every important act of his life, it pervades all his thoughts and feelings. Is he friendly? he smokes with you the calumet, the symbol of peace; and in the fleecy clouds rising from his pipe and mingling with yours, merging and floating away as one, you see a symbol of his unison with you in thought and sentiment, as beautiful and appropriate as the clouds of incense, typical of atonement, wafted to heaven from the swinging censor of the Israelitish priest. Nor is it only to Indian life, or even

mainly, that these remarks apply; they are universally applicable, varying only in accordance with the degree of imaginative and creative faculties. Do my hearers need to be reminded of the early history of the Celtic inhabitants of the British Isles; the symbolic sacrifices of the Druids; or the pagan theology of the Danes, Norsemen, and Anglo-Saxons? Even now Symbolism lingers in our own habits and most cherished customs to a degree we scarcely suspect until we come to analyze them. The Mistletoe which we inherit, as well as the Oak, the Ivy, and the Holly, in their symbolic uses, from those very Druids of whom I have been speaking, becomes very useful about Christmas time, and gives a decided zest to our parties and friendly gatherings: ay, and occasionally leads to the use of another symbol for which we have a great respect, viz., the Ring—the emblem of eternal union—a symbol we may trace through every style of Art, Christian and Pagan, until it vanishes into pre-historic time, fit emblem of its own appropriateness. The exchange of Easter Eggs is another symbolic custom inherited from a remote ancestry; but how many think of its beauty as a type of the resurrection of the soul to a future state? containing, as every egg does, the germ of life. The primitive habits of our country people of Cumberland and Westmorland teem with customs of distinct symbolic origin, although in many instances little suspected or understood; and those of the Highlands of Scotland have been made familiar to us by the works of the great northern wizard, Sir Walter Scott. I will only advert to one of these, viz., the custom which formerly prevailed of sending the Fiery Cross, the symbol of war, to summon help from the neighbouring clans.

. . . .

The grisly priest, with murmuring prayer,
A slender crosslet formed with care,
A cubit's length in measure drew—
The shaft and limbs were rods of yew.

. . . . .

Wo to the clansman who shall view
This *symbol* of *sepulchral yew*,

Forgetful that its branches grew
Where weep the heavens their holiest dew ,
On Alpine's dwelling low.

. . . . .

Wo to the wretch who fails to rear,
At this dread Sign, the ready spear ;
For as the flames this symbol sear,
His home, the refuge of his fear,
A kindred fate shall know.

. . . . .

Far o'er its roof the volumed flame
Clan Alpine's *vengeance* shall proclaim,
While maids and matrons on his name
Shall call down wretchedness, and shame,
And infamy, and woe.

I have briefly endeavoured to show that the love of symbolism is a kind of instinct in man, and is adopted by unlettered races living in various climes and in various conditions of existence, as the readiest means of communicating ideas; where, without it, in fact, they would have had no means of communicating ideas at all. But if this is so amongst the cold apathetic races of a temperate clime and a western sky, how much more would it strike root and flourish among the fervid and impassioned tribes of Asia, under the burning sun of the torrid East; the land of song and tradition; the birth place and cradle of the human race? The sacred writings teem with illustrations of this truth, and the history of the Israelites, as contained in the Old Testament, is one long struggle with the idolatrous worship of symbolic forms, of which the real meaning and original intent has been lost and misunderstood. I feel much tempted to linger over this part of my subject, but it would detain me from the more immediate object of my lecture; I will therefore only remind you of one of the earliest and most striking instances of the use of symbols, which is contained in the 49th chapter of Genesis, where Jacob illustrates by symbols the characters of his sons, fortells the future of the tribes which shall descend from them, predicts the coming of the future Shiloh as the offspring of Judah, whom he describes as an old lion. Who, he says, shall stir him up? How pregnant with meaning is his comparison of Issachar to a strong ass crouching between two

burdens; and of Dan, who should judge his people, to a snake—an adder in the path, who biteth his horse's heels so that his rider should fall backward; of Napthali to a hind let loose "he giveth goodly words;" Joseph is a fruitful bough, by a well, whose branches run over a wall; and Benjamin—the fierce and warlike Benjamin—he describes as a wolf, "In the morning he shall devour his prey, and at night he shall divide the spoil."

This subject brings me, by an easy transition, to those wonderful nations with which the history of the Israelites is so much identified, viz., the Assyrians and the Egyptians. The creators and founders, so far as we at present know, of the first great schools of historic, and especially Symbolic, Art. The Assyrian Empire is said to have been founded by Nimrod, and its original seat was Babel or Babylon, about 2,200 years before the Christian era. The Seat of Empire was afterwards moved to Nineveh. It lasted about 1,400 years, when it was divided into two kingdoms, which endured about 200 years longer. During the whole of this long period the history of the Assyrian people must have been the history of the arts and civilization of the world; and I know of no study more interesting than the unfolding of its hidden pages, for, marvellous as it may seem, it is nevertheless true that the mighty volume, after being hidden in the earth over two thousand years, is now being brought to light. Up to 1843 the history of the Assyrians was conjecture and tradition; now it is an open book, the pages written in huge characters of stone. Even the type of lines and symbols, which seemed a hopeless enigma, has yielded to the untiring industry and ingenuity of those who have devoted themselves to the task of deciphering them. The folios of ancient history are there found, illustrated by artists contemporary with the scenes depicted; and we find, as in the pages of a mighty "Graphic," the story of the Kings of Chaldea, including many of those, as it is supposed, mentioned in holy writ. One of the latest discoveries is a complete narrative of the history of the Flood, and portions of a great work on Astronomy and Astrology, as well as a history of the Comets, the whole of which, it is hoped, may some day be brought to light. Interesting as are

the discoveries hitherto made, they are as nothing to those which remain to be explored, for, as an eminent writer* observes—"The whole of the history, and almost all the literature of the age of Nebuchadnezzar, now lies buried in Babylon."

From an artistic point of view, these discoveries are equally important, if only from the light they cast on the schools which followed. For it is now evident that marvellous as were the triumphs of Greek Art in their sublime conceptions of the beautiful, we are enabled to trace their origin in Architecture to the pre-existent schools of Assyria and Egypt. "These two stand, and probably will remain the primitive styles of the human race."†

It is not within the scope of this lecture to go deeply into the records of Chaldean superstition, but we know that it must have been built mainly upon cruelty, and owed its power to its means of inspiring awe and terror. Human sacrifices to the gods were the means of averting divine wrath, and the aid of science was invoked by the priesthood to rivet the fetters of their influence. It was a great pastoral country, and the shepherds watching their flocks by night along the vast valley of the Euphrates, became familiar with every aspect and change of those starry constellations, which rolled their silent wheels above their heads, and learned to read their fate therein. Lucky and unlucky signs and symbols came to rule the most trivial and common-place events of their lives. Can we wonder at this when we consider the revelations which are made at the present day of learned societies and a free press, amongst ourselves. The Gipsy Fortune-teller on the race-course does not find her dupes only amongst the poor and ignorant when she practices, or professes to practice an art which she claims to inherit by direct descent from the very people of whom I now speak; and every newspaper will show that no class of society can yet claim exemption from the charge of weakness and credulity. It is to the Assyrians that we may trace the invention of the fable and the allegory, for the earliest known works of this kind are amongst recent Assyrian discoveries. These inventions in literature are closely allied to the tales of Genii, the oriental ancestors

* Layard. † Ferguson's Hand-Book of Architecture.

of the Western Ogres, Gnomes, and Fairies. The Phoenix, the Griffin, the Chimera, the Dragon, and other mythical creatures were originally used, no doubt, as symbols, but afterwards adopted by the ignorant and credulous as real creatures, and transplanted by Eastern travellers and crusaders into European heraldry and tradition. There can be no doubt of the worship of the heavenly bodies by all Eastern nations, and the influence upon them all, of Egyptain and Assyrian mythology, may be distinctly traced by their symbolic decoration. The sun being in its conception merely a symbol, the noblest and grandest of the works of God, the medium of heat and life, was afterwards regarded as the creator itself, and worshipped as the Osiris of Egypt, and the Baal or Bel of Chaldea. The Persian worship of fire was of similar origin; and a host of symbols, such as the mystic Fir Cone, the Sphinx, the Winged Bull, and the Winged Lion, were used to perpetuate and extend the imposture. Time will not permit me to linger over Assyrian Art, as its leading features are closely allied, and in some respects identical with, the Egyptian, of which it is, in its later periods, a development; but those who wish to investigate the subject further, will be well repaid by the perusal of the works of Layard, G. Smith, Niebuhr, and other eminent writers.

Our knowledge of Egyptian Art is much more complete than that of Assyrian, but to comprehend the barest outlines of it, we must know something of the people themselves, their climate, and the conditions under which they live. The original occupation of Egypt is a matter of, at the best, vague tradition; but it is stated that Middle and Lower Egypt were first occupied after the flood by Ham and his descendants, who being driven from their homes, and subjected to heavy losses by the inundations of the Nile, before they understood the natural laws by which those inundations were governed, many of them retired to Upper Egypt, where they built the city of Thebes, and founded the first great Egyptian empire. I say the first, because that empire was divided into two distinct periods, and existed under widely different circumstances. The first period probably dates from about 1400 B.C. to 525 B.C.; and it was during this period that the pyramids were built, which

colossal monuments will serve to perpetuate to still future ages the grandeur and magnificence of the Egyptian race. The second period dates from 323 B.C. to 30 B.C., and its chief city was Memphis, in the Delta, or Lower Egypt, so called from the resemblance the shape of the country bears to the Greek letter Δ, and it is to this second period of empire that the obelisks are attributed, one of which has now, after so many vicissitudes, found its way to our shores.

The great feature of Egyptian life which stands out preeminently above all others, is the influence on their habits and customs of the periodical inundations of the Nile, that marvellous flood which from the beginning was a mystery, to the solution of which the bravest of Englishmen have devoted their heroic lives—a sacrifice that even now seems to be achieving its destined triumph. The original settlers in Egypt were preparing to cut down their harvest when, without rain or other previous warning, the river swelled. It overflowed its banks, and spread over the whole country, sweeping away the dwellings, the cattle, and even many of the inhabitants themselves. Those who persevered in their occupation of this part of Egypt found that the alluvial deposit remaining after the inundation had subsided, left the land a fertile garden. They therefore set themselves to guard against the recurrence of their losses, without relinquishing their hold upon the country. With this object, they organized a class of wise men, or magi (the magicians mentioned in the Scripture), whose special duty it was, by their scientific researches, to guard the common people against a recurrence of their calamities. It is to these magi, in Egypt, as to those in Assyria, that the pre-eminence of their country in art and science may be attributed; and it is, I think, evident that while they carried their own researches into the most hidden depths of Nature and Science, as far as their means would allow, it was no part of their policy to have the masses of the nation equally instructed. The very significance of their symbolic teaching implies an appeal to the simplest and rudest order of intelligence; and by perpetuating the ignorance of the mass, they were consolidating their own power and influence. To such an

extent was this caste influence carried, that men were not allowed, excepting under the most exceptional circumstances, to rise above the class to which they originally belonged; and children were compelled by law to follow the occupation of their parents. The discoveries of the magi of these countries are therefore the history of art, for their art is in fact, in Egypt, symbolical and hieroglyphic caligraphy.

Interesting as this subject is, I must deal with it in the briefest possible manner. I have already alluded to the proficiency to which the Assyrians attained in the study of Astronomy; this proficiency was shared by the Egyptians. Early in the history of Egypt we find the country over-run and subjugated by a nation of shepherds, whose severe rule was so hated by the Egyptians, that the name of shepherd—as we are informed in Scripture—became an abomination to the Egyptians, even when the foreign yoke was broken, and the invaders driven out. These shepherds were no doubt Assyrians; and in that instance, as in many others, the two races mingled their lore of arts and science, accounting for the close intimacy we find existing between the two. That the divisions of time, the signs of the Zodiac, and the principles of the solar, lunar, and stellar systems, were perfectly understood by both nations, there is abundant proof; and it is to symbolism we must look for the explanation of those signs of the Zodiac, which are so interwoven into their Mythology and Art, and handed down to a remote posterity. Thus, the habits of the people of these countries give us the solution to these signs; for we find the stars forming the constellation under which the great event of the Egyptian year occurred, viz.—the overflowing of the Nile—is called *Aquarius*, the Water-carrier. The Ox, or Bull, denotes the ploughing season; Leo, the season when the Lion, driven by thirst from the desert, invades the villages of the people, and commits his depredations in the close proximity to the river; Virgo denotes the harvest maid, or reaping time; the Ram, the breeding season among their flocks; the Crab is that season which is indicated by the stars which were visible when the sun, having reached the bounds of the tropic, moved in an eccentric orbit, backwards and forwards, like the crab; the

Goat is when the sun has attained its highest altitude, from the well known habits of that animal to seek the summits of the rocks and mountains; Libra (the Scales), when the days and nights are about equally balanced in duration; the Scorpion records the prevalence of the regularly recurring scorching winds from the desert; and so on.

Now the magi discovered that the Nile inundation was preceded by an annual wind blowing from north to south, about the passage of the sun under the stars of Cancer; and that this wind was preceded by a particularly brilliant star, which was selected as their warning to the people of the coming inundation. This star, because it served as a warning from danger, they depicted as Thayaut, the watch dog, or Anubis, the dog star. In Hebrew it is called Sihor. Its Latin name is that by which it is familiar to us, viz. Sirius. This star is honoured amongst Freemasons as the great Blazing Star of Freemasonry, and is one of their most ancient and honoured symbols. The wind to which I have alluded, and the return wind which stopped the inundation and drove the waters back, they typified by two birds—the Hawk and the Hoop or Hoophoe. The Hawk, because at the return of mild weather it is the habit of that bird to make her way south, with her wings spread towards the quarter from whence the warm air comes; the Hoop, on the contrary, wings her way from south to north, living on the small worms which are hatched in great numbers in the mud left behind by the inundations of the Nile. The symbols bearing on this subject are very numerous, and were used by the magi as means of warning. The Dog Star was symbolized in a variety of ways, but the commonest was the figure of a man, with the head of a dog. This figure, exhibited in suitable localities, gave warning of the coming inundation. It bore on its arm a kettle or porridge pot, to indicate that provisions were necessary. Wings on his feet denoted the urgency of flight; in one hand he holds a feather, and behind him a tortoise or a duck is placed—both amphibious animals—typical of the coming inroad of water. Another common means of expressing the rising of the water was by lines in the form of a cross, and surmounted by a globe or

circle, expressive of the providence of God. Another method was by pitchers or measures of unequal size, called canopi, decorated with the crosses referred to, and surmounted by birds' heads, typical, as I have explained, of the prevailing winds. Sometimes the head of a dog, and at others a female head, marked the state of the river under the sign of the Virgin, when the water begins to subside.

As the Egyptians had their warnings and friendly symbols, so they had their symbols of hatred and fear. They conveyed their horror of the ruin wrought by the stormy winds which drove on the floods, by depicting some terrible form—a dragon, or other composite animal; a sea monster, a crocodile, or a hippopotamus; and sometimes a nondescript which they called Ob—a swelling, an overflowing; or Python, the enemy.

It is evident that in so elaborate a system as this, in which the constellations play so conspicuous a part, the Sun and Moon must occupy a prominent position. Accordingly we find the Sun typifying the Source of all good, as the symbol of the Almighty,—the King, the Ruler,—expressed in the figure of a man, bearing the sceptre, or a whip; and frequently by another Masonic symbol, the eye. The type of the Moon was a woman bearing on her head a crescent; and it is remarkable that this figure was also intended to typify not only the Moon, but the prolific *Earth*. Indeed, in the process of time all these symbols assumed other meanings, and from their simple outlines grew that mighty superstition, the Pagan Mythology. The Egyptians came to regard the male figure—emblem of the sun, or solar year, as a real personage, and paid him divine honours under the name of Osiris. The female they called Isis, his wife, and they had a circumstantial narrative of their supposed history. This narrative gives the clue to the origin of most of the heathen deities. For just as the Egyptians themselves had various symbols to denote the same being under varying circumstances (for instance, another of their gods, Horus, indicated the sun, as well as Osiris), so the Greeks and Romans adapted the Egyptian deities to their own requirements. Thus Osiris Ammon found his parallel both in Jupiter Ammon and in Apollo; and

indeed, the story of Apollo slaying the Python is palpably Egyptian, and alludes to the rays or arrows of the sun dispelling the mists and fogs exhaled from the slimy inundations of the river. Ceres is another name for Isis, and is pourtrayed with sheaves and a sickle in a precisely similar manner; but Isis is also the prototype of Venus, under the Egyptian name of Ken; and is in Assyrian, Astarte, the emblems and attributes being identical. Hercules was one of the Generals of Osiris; and I might pursue these comparisons to a wearisome length. The narrative, however, of the death of Osiris, caused by Python, and his resurrection as typified in a picture on a mummy cloth in Paris, is evidently symbolical of the ruin caused by the inundation of the Nile; his rescue by the returning seasons under the stars of Leo; his period of repose and final resurrection. This accounts in the simplest possible way for the whole mythical story.

I must briefly allude to a few other prevalent Egyptian symbols frequently recurring in Art, before leaving the subject. Of these the Sphinx is the most important. There are many suggestions as to its meaning: one is that it is a combination of the constellations of Virgo and Leo. This is, however, an error, so far as Egypt is concerned, because the Egyptian Sphinx is never female, but always male, and sometimes human headed, but frequently hawk headed or ram headed. The Sphinx, however, is as common in Greek art as in Egyptian, with this difference—that the Greek Sphinx is exactly the reverse of the Egyptian; it is always *female*, and it is *winged*, which the Egyptian never is.* I believe the true solution will be a symbolical one, viz.—that it is intended to convey to the Egyptian mind a type of God's providence and guardian care, combining, in a manner most highly figurative to them, the human intellect with the courage and power of the lion; whilst its immense proportions convey—in a manner congenial to the Egyptian mind, the idea of superhuman and supernatural endowments. The variety of heads given to the oracle may be accounted for in a manner suggested in the earlier

* See Sir Gardner Wilkinson's *Egyptian Antiquities*.

part of my lecture, by a reference to the peculiar wants or circumstances of the people in various localities. The hood or cap on the head of the Sphinx is generally supposed to be a throne, and alludes to the sovereignty of Upper Egypt.

The Winged Globe comes next in importance, and is a type of the enduring providence of the Almighty. This explanation is equally applicable to the Scarabeus or Mystic Beetle; but the latter admits of a fuller and more comprehensive meaning. This is contained in an examination into the habits of this singular insect, when its apparent absurdity as an emblem of God's providence must yield to a sense of its beauty and appropriateness. It is thus explained. The Scarabæus envelopes its egg in a ball of clay, and this ball, teeming with the germs of life, is adopted as the type of the present world. It is rolled by the insect with laborious care to a suitable place, where it is buried to a sufficient depth in the soil to protect it from the effects of the approaching inundation of the Nile. Here is symbolized the tomb. The chrysalis represents the mummy state—death as a transition to the perfect day, when the Nile having retired, the grub emerges from its swathings, and soars into ethereal space, emblem of resurrection to eternal life. It would be difficult to conceive a more appropriate symbol to the Egyptian mind of his belief in a future state and the immortality of the soul.

Next in order in Decorative Art I must allude to those prevalent features in Egyptian architecture, the Papyrus and the Lotus, and point to their wonderful influence in all the schools of decorative art which follow. They are commonly used together in Egyptian ornament, and have, like all Egyptian art, a highly symbolic meaning. They represent the intellectual and material wants of man. Thus the Lotus, or water lily, is the accepted type of their great river, the Nile, to which they owe the fertility of the soil, and to which they are indebted for every material necessity of their daily existence. The Lotus will be found as commonly adopted in Assyrian as in Egyptian art, especially in its latest forms, when the Assyrian may be said to bear the same culminating position with regard to Egyptian, as Roman bears to Greek art.

There is perhaps no ornament of such universal application; its varied developments furnish some of the most beautiful features of every school which follows. It is the anthemion of the Greek, and, with very slight alteration from the original, furnishes the fleur-de-lys, the proudest blazonry of the Merovingian dynasty of France. The Papyrus, from which the Egyptian paper was made, represented fitly their intellectual requirements; and it is from the natural form of these two plants that we are said to owe the suggestion of the pillar, which may be said to be the foundation of Architectural Science. The Palm is next in importance. It represents material providence, as displayed in the vegetable world; and again we must admit the beauty and force of the illustration; "for to the Palm the native of Egypt owes--shelter from the blazing sun, timber for houses and temples, and other varied wants. Baskets were made from its branches, and cordage from its fibres. It furnishes thatch for his roofs, and fruit for his table; and embellishes the landscape with its luxuriant and varied form." *

Another leading feature of Egyptian ornament perpetuated by succeeding schools is the Serpent, which, from its peculiarity of casting and renewing its skin, they used as an emblem of health and vigour, as Moses used the brazen serpent in the wilderness. Even the geometrical patterns used in Egyptian ornament—and they are very numerous—have distinct meanings, many of them plainly indicated by their names. Thus the wave scroll, the spiral, the fret or labyrinth, the zig-zag—have all taken an indelible position amongst the ornamental features of succeeding schools of architecture; and all allude to their great river in its varied features.

I have done but scanty justice to Egyptian symbolism; but time will not permit more, if I am to allude, however sparingly, to other branches of my subject. I must therefore conclude by observing that the great features both of Egyptian and Assyrian art are—grandeur of proportion, colossal size, gorgeousness of decoration, and richness of material—gilding, colour, gems, and ivory being freely used.

I have already alluded to the fact that the Greek Mythology

* Eygpt of Pharoah and the Khedive.

is a development of the Egyptian and Assyrian, the same deities being worshipped under various names, but with the same symbols and attributes. This is so well known that I will not further dwell upon it, but rather direct attention to the wide difference of artistic treatment between the two schools. It is this:—In the parent school, artistic treatment was kept subservient to the symbolic. In the Greek school, beauty is the great aim of the artist; the symbolic meaning, where it exists, being kept subordinate to the study of the beautiful, and more frequently discarded altogether. It is to this fact that the world owes those glorious productions of Greek statuary, in which the genius of man seems to find its culminating development. Indeed, gazing on those marvellous forms, where the majesty of the Creator seems stamped on the divine image, it is difficult to imagine the lives of those producing those works as other than pure and holy. The light of christianity had not yet dawned, and could the teaching of paganism have been maintained as here symbolized, the soil would indeed have been ready for the seed, and the harvest sure and abundant. This could not be, however, and the weakness of Pagan philosophy was apparent in the voluptuous degeneracy of its mythology. If symbolism disappearing from Greek sculpture is kept subservient to artistic treatment, or utterly abandoned, as some say, it is still more true of decorative ornament. We have here the Egyptain symbols re-produced for their beauty alone, and this is but natural amongst a people to whom their meaning would be a mystery: the conditions of their daily existence being so different. In architecture and in ornament the world gained greatly by the change. The Lotus and Papyrus caps of pillars, the symbolic Caryatides and Isis heads and other deities, give place to the succeeding developments of the three great orders of the Greek schools—the Doric, the Ionic, and the Corinthian; but in the friezes and other decorative features, we find Egyptain ornament distinctly perpetuated.

The Roman school of ornament is merely a development of the Greek, adding to Greek details a gorgeous magnificence of treatment peculiar to itself. It consequently claims no originality

of invention, although it combines with the more severe simplicity of Greek forms, the use of grotesques, or combinations of human, animal, or vegetable ornaments. There is no symbolic meaning in their delineations; no attempt to appeal to any other sense than that of beauty or grace, although the use of the Griffin, the Sphynx, or other forms of symbolic origin, is much more frequent in Roman than in Greek art. Perhaps the only really distinctive ornament the Roman school can claim, is the *Shell*, one of great importance, however, being afterwards one of the most important features of the Renaissance.

We now come to the next great symbolic style of art, viz., the Early Christain, with its development, the Byzantine, and to comprehend even the barest outlines of this subject, we must again glance at contemporaneous history. I must remind you for a moment of the might, the majesty, the magnificence, the cruelty, he vice, the sensuality, and the voluptuous degeneracy of that great Empire of Rome, which never seemed so superb and gorgeous as when on the brink of destruction. Like some mighty ship, manned by a drunken crew, with all sails set, driving right ahead for the rock-bound coast, where the sullen roar of the breakers is already heard, and the white surf is dimly seen. I must remind you of the peculiar tenets of Christianity, which made it a revelation of freedom and light to the poor and ignorant toilers of Rome; whilst it came as a rebuke and menace to the great and mighty. Early Christian Art is in fact the history of the early struggles of Christianity: it tells in touching and pathetic language of its secrecy, its dangers, its tenacity, its faith, perseverance, simplicity, and heroism; its endurance amid trials; its hidings in caves and tombs; its martyrdom; its fortitude through all; its success; its triumph—all are symbolized here; the cycle of time is rolled back again, and though with widely different conditions, we revert to the same objects and motives which actuated the origin of Egyptain and Assyrian art. The first and second centuries, therefore, of the Christian era, yield not only a record of the gradual triumph of Christian doctrines over Pagan idolatry, but an illustration of the triumph of the austere principles of Christian symbolism over

the sensuous beauty of Heathen art. Forms beautiful and harmless in themselves were condemned because they were associated with Heathen customs and worship, and were replaced by outlines crude and unattractive, but embodying the principles of that faith which conveyed to the hungry the assurance of the bread of life, and to the thirsty that of living water. These early symbols are the monogram of Christ: the Lily, the Cross, the Serpent, and the Aureole or Vesica-pisces. This Aureole enveloped the whole person, and represented the acrostic symbol — the fish, from the Greek word being composed of letters which initial the following: Jesus Christ, God, Son and Saviour. The fish was also commonly used as the emblem of baptism. The dove was used in various ways; it was the emblem of peace and reconciliation; it also symbolizes the freedom of the departed soul; but when the dove bears the nimbus, it has a higher meaning, and symbolizes the Holy Ghost. The Olive branch is also a symbol of peace, though of well-known Pagan origin, being used in exactly the same sense by Minerva in her celebrated contest with Neptune, to denote the highest gift of the gods to man. The Palm branch denoted victory, and is equally of Pagan as well as Biblical origin. A Ship was sometimes used to signify the Church. When used in combination with the Fish, it expresses Christ supporting His Church. The Vine is also a frequent symbol of Christ's Church. But the most important feature in early Christian Art is the Nimbus. It was the glory encircling the head, combinations of which form the well known Byzantyne and Gothic trefoil and quatrefoil, the former denoting the Trinity, and the latter the four evangelists. So important is the Nimbus, that it is described as the key to the Archæology of Early Christian Art, and volumes have been written on its details.

But more immediate to my purpose it is to show how Art, like History, repeats itself. We find the mystic triangle of the Egyptians, which forms the basis of the design of the pyramids, reproduced as the symbol of the Christian Trinity. The Cross, so common on Egyptian monuments, is now the glorious type of the resurrection; and even the Tau, the Egyptian sign of life, is

literally copied as one of the forms of the cross used in Christian Art, and known as the cross of St. Thomas. The Serpent, the Lion, the Dragon, the Peacock—all Egyptian—are also prominent Christian symbols; and there is no difficulty in tracing such forms as the Winged Ox. the Winged Lion, the Eagle, and the Winged Man, to a date far antecedent to the time of the four evangelists whom they symbolically represent.

How dangerous to the unlettered mass the fertility of the artist's imagination may become, in the unfettered production of heavenly symbols, may be well illustrated by the Tetramorph, a mysterious being with four heads, surrounded by Nimbi and numerous wings covered with eyes. It stands on two fiery wheels or stars, also winged. It may be seen in a Byzantyne mosaic in a convent at Mount Athos. A fable long believed in by naturalists is perpetuated in Christian symbolism, adopted from Egyptian, viz. the Pelican feeding its young from the blood on its breast. It was used as an emblem of Christ, and is well known as a favourite device of the Church of Rome.

On the various forms of crosses used in Christian Art, a volume might be written; and the same may be said of the monogram of Christ. They are, however, so familiarly known in their ordinary forms, that I will not dwell upon them, but pass to another feature of the subject, less understood, viz. the meanings attached to colours, metals, and precious stones. When tints are used by early artists of this school, it is necessary to remember that the artist is not merely a colourist, but a preceptor; he is not only painting a picture, but he is preaching a sermon; consequently he arranges his colours less to produce a pleasing effect to the eye than to appeal to the mind by their symbolic significance. Silver in metals and white in colours, were used as symbols of light and life, innocence and purity; pure yellow and gold denoted faithfulness, brightness, and the goodness of God. Impure or dingy yellow was used to denote the exact reverse of these qualities—deceit and jealousy. Judas Iscariot is generally depicted in robes of this tint. In the same manner every colour has its well known symbolic attribute. The canonical colours are black (which is

used on Good Friday only), white, green, violet, and red, and have each their separate festivals and fasts at which they are respectively used as the prevailing colour. In precious stones, the diamond has the same significance as white and silver. The ruby signifies love, dignity, royalty; the carbuncle, blood and suffering—our Lord's passion and martyrdom; five carbuncles on a cross mean our Lord's five wounds. The sapphire denotes truth; the emerald, exalted faith; and the pearl, innocence and humility.

In treating of Christian Symbolism, I have necessarily dealt with it as a whole, embracing its principles from their conception in poverty and persecution, among the poor and ignorant outcasts from society, hiding in the catacombs by hundreds;—and how vast these catacombs were, may be understood by the fact that they measure from 800 to 900 miles in extent, and are assumed to contain from six to seven millions of Christian dead. The primitive Christians met here by stealth, hunted down like malefactors, holding their lives by a thread that a breath might sever; denounced, pursued, torn by wild beasts in the arena, mid the exultant roars of the still more cruel crowd. There is no fancy sentiment in this view of Christian Symbolism; no poetical mind adorning its devotional aspirations in a garb of Oriental splendour. It is a bare struggle for spiritual existence; a tenacious and desperate hold of drowning humanity, which none might sustain but such as realized the full meaning of the words "other hope have I none," "simply to Thy cross I cling." And from this point of view, what a world of meaning is there! What a vista of bygone hopes and fears, joys and sorrows, we gain by a contemplation of those crude, hard outlines of crosses and doves, serpents and fishes, which are scratched, rather than sculptured, on the walls of the catacombs, and in the relics of the purlieus of Ancient Rome.

But when Constantine embraced Christianity, all was changed. Christian Art, still pure, intolerant, and ascetic in its principles, as opposed to Pagan Art, sought development and expanse by the free amplitude of its details. The use of gorgeous materials and colours became the rule, and emblems of shame and servitude were adopted in their turn as the proud insignia of victory. Christianity

became the fashion, and lost in its triumph much that made the triumph worth the winning. In the progress of time Christian Art lost its stern simplicity of symbolic teaching, but artistically gained more than an equivalent by engrafting on to its principles the splendid features of Greek and Roman Art. This blended style is commonly known as Byzantyne.

In this school or epoch of art, we find the old classic scrolls combined in their details with the lily and the trefoil, the cross and the monogram. More and more latitude is taken as the study of the beautiful is permitted and encouraged, until it eventually culminates in the gorgeous beauty of the Romanesque.

When the degenerate Roman Empire fell to pieces, and Europe was over-run by barbarous hordes, symbolism again played a vitally important part. Society was unconsciously undergoing a purifying process; but during this time, commonly known as the dark ages, the masses of the people were sunk in ignorance and barbarism. Religion was the only home of the Arts and Sciences, and outside her pale another institution had to fill the place of civilization: this was called Chivalry. Both Religion and Chivalry had to work upon the imagination and the intelligence. Compelled by necessity, both employed the same primitive agency: both adopted the language of symbolism. Thus we find our Gothic cathedrals and churches built on the ground plan of a cross; their niches full of saints and virgins; their windows had tracery of trefoils and quatrefoils; and the stained glass contained effigies of saints and martyrs, apostles and evangelists. They carved their misereres and stone capitals with types of the seasons, and taught the people to behold the goodness of the Creator in the bounteousness of His works. Unconsciously also they went further back, and in their steeples they copied the obelisks. They ornamented their arches (the construction of which in its principles they owe to the Egyptians,) with the zig-zag, the emblem of the Nile. They carved lions, masks, and fantastic heads on their gurgoyles, which may find their prototypes in Egyptian, Indian, or Chinese temples; and on their crockets we find numerous varieties of the mystic lotus.

We now turn to Chivalry; and here we find Symbolism organized and cultivated as a science, under the title of Heraldry, with complete paraphernalia. Their society was a College of Arms; their professors were Kings of Arms; and their ushers were Heralds. They had missionaries in the Troubadours, who nursed in those dark times the love of poetry and song. By means of this singular institution a power was created which exercised a wonderful influence. The most powerful of the nobility bowed to its sway, and its laws were as absolute as those of the church itself. The proudest monarch would have deemed the chopping off his golden spurs—the symbol of his knighthood—an evil not inferior to the loss of throne, lands, or power. Gallant feats of arms were considered amply repaid when their heroes were permitted to perpetuate them by the acquisition of some symbolic device to add to their armorial bearings; and in the Crusades we have the solution of the importation of oriental symbolic animals into the heraldic system of the less imaginative, but not less superstitious, people of the west. The Phœnix, the Salamander, the Chimera, find their origin here; so do Dragons and Wyverns. The Mermaid (the western version of the Syren), the Cockatrice, the Basilisk and the Unicorn, all of evidently eastern origin, and symbolic in their combinations. Indeed the mediæval knight, bearing on his helmet a boar's head, surmounted with plumes of feathers; a coat over his armour quartered with lions and panthers, and bearing on his shield a flying spur, is only the development of the same train of ideas embodied by the Indian in his war paint, alluded to in the opening of my lecture, and would proclaim, without any necessity for the herald's flourish, that he was as strong, as brutal, as fierce, and as fleet a foe as any savage of them all.

Sometimes, indeed, popular ignorance will persist in making mistakes; and some emblazonments have become sadly perverted from their original meaning. There is no more remarkable instance of this than in the patron saint of England, St. George, who is represented on horseback, slaying a dragon. The St. George alluded to is said to be George, Bishop of Cappadocia,

who probably never wore armour, except that of controversy. The Dragon is Sin and Error; although, if Gibbon's account is true, the sin is as mythical as the armour; and George's claim to be considered a saint at all is of very doubtful kind.

The figure of Britannia bearing the trident of Neptune seems a more appropriate emblem of our tight little island, though somehow it has a very pagan look; the figure being as evidently Minerva, as the trident is filched from the sea god. The only bit of Christianity about it is the Union Jack on the shield, which is a combination of the crosses of our various nationalities. We have our national flowers too. The Rose was the emblem of the rival houses of York and Lancaster; and the Thistle, with the proud motto, "*nemo me impune lacessit*," has been well and worthily born by the gallant Scots; but the most poetical and beautiful national emblem is the Shamrock of Ireland, which, as the legend tells us, was used by St. Patrick at a critical moment, as a symbol of the Trinity, to show the hesitating people how nature has combined three in one, and so, by making clear to their minds a seeming impossibility, decided them to adopt the Christian religion.

I have now completed my sketch of the Symbolic Schools of Art. At their influence on our own times I cannot do more than glance. It is impossible however to over-rate their importance in art teaching. Kept alive in the monasteries and convents during the dark ages by the influence of the Church, they inspired and developed many of the features of Gothic ornament; for although in its essential features Gothic architecture is pointed and geometrical, it preserves all the symbolic elements of the Byzantyne period, combining with them adaptations of natural plants and flowers in endless variety and profusion.

It is certain that a study of Symbolism is absolutely essential to a right understanding of Mediæval Architecture, for it furnishes the clue to meanings which otherwise seem hopeless absurdities, and the vagaries of an eccentric or distempered imagination. But these meanings will well repay study. These old monks never did anything without a purpose and a meaning, and they devoted an

amount of time and earnest thought to the elaboration of the details of their work, which is rarely achieved in these go-ahead times. Their work was like their pace—a walk. They had time to digest every detail of the landscape in their earnest gaze; we race along by steam, and talk by telegraph and telephone; but we see so much that we see little long. We see it also superficially and imperfectly, and there is much that we ought to see that we never see at all.

I am aware that there is a disposition to over-rate Symbolism, and to attach in some quarters too great and over due importance to it. But while we deprecate such exaggeration and extravagance, let us take care that we do not go into the other extreme, and deny it any interest and importance at all. The best security against the abuse of symbols is to study them for ourselves, and learn their true meaning and value. As a means of communicating ideas, as an educational medium, symbolism owed its usefulness to its faculty of appealing to the sense of sight of an illiterate, but an earnest and devout, people. The spread of education, the increase of schools and churches, has superseded this necessity. Its chief value—and it is very great—lies in the clue it gives to past history. It is not Religion, and it is not Art, but it is a very valuable aid to the study of both. It carries the mind back to remote ages, and raises—be it ever so little—that mysterious veil which enshrouds the story of primeval man. It links the living present with the mighty spirits that have long passed away; and whilst it strengthens the bonds of a broad, reflecting, and enduring faith in ourselves, it preaches above all things—humility and wide toleration of the opinions of others.

HALF-AN-HOUR WITH A FEW COMMON BEETLES.

By WM. DUCKWORTH.

(Read at Carlisle.)

The subject we have chosen for our paper to-night, though not a popular one, is one which, we trust, will prove of some interest to you all. Perhaps the general idea of beetles is confined to the cockroach or black-beetle of our cellars (which, by the way is not a beetle, but belongs to the cricket family) or perhaps to the pretty and useful lady-bird or the dor beetle, which goes under rather a vulgar name locally; and it is rather surprising that, generally, so little interest is taken, even by entomologists, in such a numerous and strange class of insects. The life history of some of our beetles reads like a fairy tale; and some years ago the narrators of each would, we are afraid, have been credited with the powers of Baron Manchausen. We could tell you of one beetle, whose bundle of small yellow eggs is laid in a hole in the ground; the eggs are soon hatched into free creeping larvæ, something like miniature spiders, which climb the nearest flower stem to the blossom, and there wait the arrival of some unfortunate bee, in search of honey or pollen; they now leave the flower and cling to the bee, and so get carried to the nest, where their first duty is to eat the bee's egg, and then change into the true larval form. They find enough nourishment in the food which the bee had provided for its young, to carry them through the various stages to the perfect insect, known as the Oil Beetle, *(Melor Cicatricosus,)* which deserves its name from a curious habit it has of distilling a yellowish oil from the joints of the legs on being handled. We could also tell you of the Bombadier Beetle, armed with a stern

chase gun, which, when pursued by its enemies, discharges an acid that volatilises on coming into contact with the air, with noise and smoke. Our efforts to-night are of an humble description, and will be confined to a few locally common beetles, and whose habits may be studied almost at any time.

In a young Society like ours, it would have been more in keeping if we had given you some idea of the external anatomy of the beetle, and their arrangements into sections and families. This, however, is rather dry work at first, and we preferred to make the paper more of a popular character; and if by so doing we can interest anyone in the study of our Coleoptera, our object will have been attained. The study of beetles—though they form the first order in the class Insecta—has been very much put aside for the more pleasant one of their brilliant cousins, the butterflies and moths, and we think unworthily so, playing, as we believe they do, a greater part in the economy of nature than the Lepidoptera. Therefore there is plenty of room for the study of Coleoptera, especially in our own neighbouthood; and a good collection of local beetles would add very much to the interest of the museum. There is some difficulty in the classification, more so perhaps than other insects; but this disappears on close application, and the manipulation of them is so easy, that there is little fear of spoiling a specimen after you once have got it. One great drawback in studying the life history of beetles, is the difficulty of rearing them from the larvæ, it being impossible to breed many of these artificially, especially the carnivorous ones, and many others take two and three years to come to maturity.

Taking the few beetles we shall bring forward to-night in their proper order, the first one we have to say anything about is the Common Tiger, known scientifically as *Cicindela campestris*, section *Geodephaga*. This is a good representative of the carnivorous beetles, its whole life, both during its larval condition and as a mature insect, being one scene of rapine and slaughter. It it also one of our most beautiful insects, its prominent colors being green, yellow, and bronze of many tints; and on seeing it flying on a hot sunshiny day—in which the beautiful steel blue of

the abdomen is shown, it glistens like a jewel: this has earned for it the name of the "Sparkler" Beetle. It is a very active insect, taking to wing almost as readily as a wasp or bee; in fact the quickest of any of our beetles, and being equally energetic on its legs, walking or running. On being handled, it emits a delicate scent, of what we should say was rosemary, but has been variously described as lavender, musk, roses, and sweetbriar. The Tiger Beetle delights in sandy banks, and if with a southern aspect so much the better; for in such a soil its peculiar larva finds a home and food. The body of the larva is divided into thirteen segments, first, a very large and horny head, armed with a pair of powerful jaws, like sickles toothed on the inside, so that there is no escape for any poor insect once in their embrace; the next segments carry the almost useless feet; and the eighth projects out very much from the rest of the body, and is finished off with a small pair of hooks; this segment and the large head give the larva a very peculiar appearance. The larva digs a tunnel in the sandy soil about twelve inches in depth, carrying the earth up on its broad flat head; when the tunnel is completed, the larva climbs to the top, and, hooking itself by the small hooks on the eighth segment of the body to the side of the tunnel, it fills the top of the holes on a level with the ground with its large head and jaws, and there lies in wait for any unfortunate insect that may travel that way, which, when caught, is dragged to the bottom of the den and eaten. Deprived as it is of any powers of locomotion that would be of use to it in procuring food, it makes up for it in cunning—literally making itself into a living trap for its victims to walk into. The larva is not often seen, as it disappears to the bottom of the hole on the slightest appearance of danger; but if you know the habitat of the insect, all you have to do, is to find the tunnel and insert a stem of grass fully to the bottom, when it will be grasped by the irritated larva, which will not leave its hold till landed safely on the surface. May, June, or September are the best months for finding it; and there is a bank a few yards to the south of Heads Nook Station where you may study it to perfection.

The wonderful transformation taking place in beetle life is well illustrated by this insect. First a small egg; then an ugly—if anything in nature can be called so—nearly colourless larva, almost without the power of locomotion; then comes the great sleep of pupa life; then the fierce, handsome and perfect insect, capturing its prey not by cunning, but by its superior agility with legs and wings. The elytra, or wing cases, of the common tiger beetle, to the eye alone, are of a dull green or shagreen, spotted with whitish yellow or buff; and it is only with the aid of the microscope that the real beauty of the insect is seen. This acts like the wand of a fairy: the dull green vanishes, giving place to a surface of little rounded knolls, each of them sparkling with green and gold reflections.

To the same section as the above belong the ground tiger beetles *(carabidæ)*, many of them apterous, or without wings; but for this they amply make up in having an extra length of limb, travelling far in search of prey. One species of them may often be seen during the summer months, lying crushed on the footpaths about the suburbs of our city. They are of various colours—bronze green, violet, etc.; and several of them are of large size, averaging an inch in length. This family of beetles is very useful in gardens, and ought not to be destroyed, but encouraged to remain whenever seen. They live entirely on insects, young slugs, etc., all of which, more or less, are vegetable feeders. The ground tiger beetles are not much seen while the sun has power, being nearly all nocturnal feeders; but they may be found during the day under loose stones, in heaps of refuse, etc. One of them, the golden tiger, *(C. auratus)* in France goes under the name of "the gardener," it is found so useful in keeping down the numbers of the cockchafer, a beetle very destructive to plant life. Another member of the Carabidœ family I wish to bring forward to your notice is *C. nitens*, one of the rarer ground tigers, but considered by Rye to be the most brilliant and effectively coloured beetle we possess. To this section also belongs a family of beetles quite different in their habits from the foregoing, namely, the *Amara*, or Sunshines, as they are commonly called, delighting,

as their name implies, in the sun's rays. The first fine hot day in spring brings them from their winter quarters, and you may see them almost everywhere, from the centre of our city—say the Cross steps—to the quietest country footpath you could find. Their principal colours are brilliant green and bronze of various hues, and the size runs from about half-an-inch downwards. In childhood we remember we had a legend connected with this beetle, that to kill one was quite sufficient to spoil the fine weather and bring on rain.

Passing by the Water Beetle section *(Hydradephaga)*, of which we might have something to say some future time, we shall go on to the *Brachelytra*, or Rore Beetles, perhaps better known as 'cocktail' beetles. Of this large section of our coleoptera—and there are about seven hundred species recognized at the present time—we shall only take two common beetles to represent them. The variation in size of the Brachelytra is something wonderful, some of them taking a powerful lens to tell what they are, while others are above an inch in length. The name Brachelytra is given from the wings being packed under very short wing cases, thus exposing a good deal of the abdomen. Some of my hearers will have had a closer acquaintance with the Rore Beetles than they may have liked; for fully two thirds of the so called flies that get into the eye in summer time, and cause such acute pain, are cocktail beetles; and it is the very act of turning up their tails, and the discharge of an acrid fluid, that cause the severe pain. The first of these beetles I have to draw your attention to is *Creophilus maxillosus*. It has no common name, though rather a common insect. But the scientific name, when translated, is very applicable, meaning the large jawed flesh-eater. And certainly it deserves it. One we kept in confinement for some time, could eat a piece of cooked meat rather larger than itself in a day; so the large jaws are not there for nothing. We were very thankful after having watched that beetle for some time, that we were not gifted with an appetite in proportion, or, we are afraid, there would soon be a scarcity of beef. This beetle may be taken by laying traps of offal, meat, etc., under stones and rubbish about a garden.

The other beetle in the Brachelytra we have something to say about, is the giant of the section, of rather repulsive and ferocious aspect, and one which you don't care about making friends with. It is commonly known as The Devil's Coachhorse *(Ocypus olens)*; and its ferocious aspect is fully borne out by its actions, being readier to fight than fly, caring little what its opponent is. Most of you, I dare say, have seen this beetle, as it has a peculiar habit of turning up in all sorts of places—about the edges of sinks, pantries, meat safes, in the bone bag, etc. The menacing attitude it puts on when alarmed, raising its head and working its jaws, while the tail is turned up over the back as if it were going to sting, makes people fight shy of it, and you had best let it alone, at least don't handle it; if you want it for the cabinet, pick it up with a pair of forceps, and drop it into the cyanide bottle, or boiling water. The bite of it would not hurt you very much; but when excited, two yellow points protrude from the end of the tail, from which is distilled a fluid, the smell of that same fluid being really something horrible. We have been trying to compare it with something else, but cannot; but we know in this case the old saying would come true—that comparisons are odious; and if once infested with the smell, it will take a good deal of soap and water before you get rid of it. It is a carnivorous beetle, though not disdaining carrion when it has the chance; and we remember once seeing the Devil's Coachhorse attack a small earthworm, which it grasped by the middle and shook, much as a terrier does a rat; the end of the tragedy we did not see, as both spoiler and prey disappeared down a hole. This beetle, like the rest of the family, uses the tail to pack the long wings under the short elytra, after a fight.

We now come to a very interesting order of beetles, and one to which we have paid a good deal of attention. We refer to the Burying or Sexton beetles, section *Necrophaga*. And it will amply repay anyone who has the time and circumstances to suit, to observe the habits of these insects. It is not at all a difficult matter to do, if you live in the country, or even the outskirts of the city. Though the burying beetles are seldom seen, they are not uncommon; working and flying as they generally do by night, and

hiding by day. But if you want to observe their habits, you have simply to place a dead bird, frog, mouse, or something of that kind on the ground,—and so much the better if you choose a piece of light sandy soil. If there are any beetles about, you will observe next morning that the bird, or whatever it may be, has sunk so much into the ground, it may be very little, it may be half-an-inch, or it may be more, according to how the work has progressed. If it has sunk at all, and you see any signs of excavation round it, you may be sure the beetles are there; and by gently lifting the turf, one or more pairs of the Sexton Beetles will be found. And it is worthy of remark that the beetles are always found in pairs; and the male beetle is the principal worker. Now, if you get a spade and remove part of the earth, beetles and altogether, put them in a big flower-pot full of mould, and cover them with a glass shade, so as to prevent their escaping till their work is finished, you will have a good opportunity of judging their ways of living. They, will, in all probability, remain pretty quiet during the day, but as the shades of evening begin to fall, they bestir themselves. Their first duty on finding a suitable substance is to help themselves, to what a citizen of U.S. would call a square meal; after that they set to business, the male, as I said before, doing most of the digging. After the body has been buried deep enough, and this occurs sometimes to the depth of several inches, the female deposits her eggs in it; they then make their way to the surface, and, using their long and powerful wings, go in quest of fresh fields and pastures new. Though the Burying Beetle finds its food by night, occasionally they may be seen flying during the day: their sense of smell must be very acute, and they are provided with ample wing power, as they must often have many a long flight before their hunt is successful. It was often a wonder with us in boyhood's days, why in our country rambles we so seldom came across a dead bird or animal. At that time we knew nothing of the Burying Beetle, but, with the expanse of knowledge, we think now, that that mystery is solved, and the solution is the Sexton Beetle. This insect by obeying a law of nature in providing for the future larva also does a signal good to us, by removing

from the surface of the earth substances which putrefy and render unpleasant, if not unhealthy, by their foul emanations, the pure fresh air of our fields and lanes. One remarkable instance of instinct, if not reasoning power, shown by the Burying Beetle, was brought forcibly to our notice some time ago. While walking by the side of the river Eden, we came across a dead rat, it had fallen with its head just on the edge of a hole from which a stake had been withdrawn. On partially raising the rat we discovered a pair of the black and orange Burying Beetle (N. Vespillo) underneath; the rat was carefully replaced, and the beetles left to continue their work. On returning some six or seven hours after, the rat was still in the same place, but had somewhat altered its position ; its head was hanging considerably down the hole, while the hinder parts where much in the same place. On lifting the body the reason was soon seen ; the beetles instead of undermining the body equally all along its length, as is their usual custom, were neatly digging away the edge of the existing hole, thus taking advantage of it to make their work less. So that in a short time, if left undisturbed, the rat would have slid down an inclined plane to a ready made grave. The query now comes, was it instinct or reason that guided the beetles to this unusual method of burial, thus easing their labours to a great extent ? At times, we believe, there is no boundary line between the two. The perseverance and industry of the Sexton Beetle is very great. In some experiments carried out by M. Glaiditsch two pair of beetles succeeded in burying in a small piece of earth—and in a short time—four frogs, three birds, two fishes, one mole, two grasshoppers, the entrails of a fish, and two pieces of meat. A man would look rather surprised if he were ordered to go and bury some huge animal forty or fifty times as big as himself in two days, taking his pick and tools. Yet a pair of beetles, armed with nothing but their feet and head, will bury a rat, fully fifty times bigger than themselves in a day. If the human race were endowed, in ratio, with a tithe of the wonderful power of different insects, we should live in a world of giants, as to strength.

We have endeavoured to give you, in a rough model, an idea

of the Burying Beetles at work, busy in the process of interring a female yellowhammer, but still life falls a long way short of nature. You need hardly expect naturally to find all the beetles on one bird; but in the district of the true burying beetles, the one you will commonly find is the handsome black and orange insect *Necrophorus ruspator;* one of them is set with elytra raised and wings spread, to give you an idea of the extent of them. The pair in deep black are *N. humator*, the most common sexton beetle, we believe, in the south of England. The other two pairs are *Silpha thoracica* and *Silpha obscura.*

In the autumn months of the year, just when slight frosts are changing the color of the leaves, numbers of the common Shrew (Sarex araneus) may be found lying dead in the fields and pathways without any apparent injury, as if some disease had swept them off. We have examined a great number of these in search of the Burying Beetle, but have never yet been successful in finding it. Dogs, we believe, will not touch the dead shrew.

In the next section of beetles, the Lamellicornia or Chafers, we have to introduce to you a rather handsome, quiet and harmless looking insect, but one which is not to be judged by its looks. Taking the Cock Chafer (Melolontha vulgaris) in all the stages of its existence, we should think that the insect world could hardly produce a greater destroyer of vegetable life. Though in this part of the country it does not exist in sufficient numbers to cause its ravages to be felt; yet in some of our southern counties, whole cornfields and pasture lands will be completely ruined by the larva of the Cock Chafer, which feeds on the roots of grasses and grass-like plants. The perfect insect is quite as destructive as the grub, and in certain years when it is plentiful, rows of trees may be seen with not a leaf on them, but their branches covered with Cock Chafers. And yet this is nothing to the damage they do in France, districts being completely laid bare as if a plague of locusts had swept over them. The children of one small town caught fourteen thousand in a few days, the farmers got tired of counting them after that and measured them by the bushel. There, their bodies are not allowed to waste, but boiled down for a coarse kind of fat,

which is very abundant in them. The antennæ of the Chafers have a very beautiful leaf-life arrangement, from which they take the name of Lamellicornia, and which is most conspicuous in the male Cock Chafer. Watching the insect opening and closing them, reminds one of a lady toying with a fan. Another beetle in this section is well known to all of you who are anglers, by the name of Brackenclock, or June bug, (Phyllopertha horticola), but which may be found quite as plentifully among nettles and other plants as brackens. If you are going for a day's Brackenclock fishing you may save time by looking for the beetles the night before, with the aid of a lamp, about places where they resort. The June bug has a curious manner of simulating death when alarmed. This it does by sticking the two hind legs up over its back, shoving the front pair out and squatting close to whatever it may be resting upon. In this rather absurd position it will continue some considerable time till all likelihood of danger is past. No doubt but this simulating of death, both in this and other beetles, occasionally saves their lives, as toads will not touch an insect unless it is moving, and birds often act in the same way.

Another well known beetle belonging to the Lamellicornia, though differing in family from the foregoing, is the Dor (Geotrupes stercorarius) alias the Watchman, the Clock, the Lousy Clocker, &c. It is one of the very few beetles that have been honored with a place in poesy. In that beautiful poem of Gray's, Elegy written in a country churchyard, it is alluded to in the line :—

"Save where the beetle wheels his droning flight ?"

Tennyson in "Claribel" says,

"At eve the beetle boometh."

While Collins in an "Ode to Evening" sings of it,

"Or where the beetle winds
His small but sullen hoon,
As oft he rises midst the twilight path
Against the pilgrim borne, in heedless hum."

We might quote more passages relating to the "Shardborne" beetle, but the above, we think, are sufficient for our purpose. The Dor Beetle, we have no doubt, is familiar to you all, and some of you may have unpleasant recollections of coming into collision

with it on a summer evening's walk. If you have, and have not been too much startled to watch the motions of the insect afterwards, you might wonder whether the beetle or you were the most frightened; you would observe it in all probability lying on its back on the ground, and as still as the dead insect it was imitating. Not a sign of life about it except the numerous parasites which might be seen crawling over it in every direction, and from which it derives the rather vulgar name of the "Lousy Clocker." The Dor beetle in laying its eggs and providing for its young, digs a hole eight or twelve inches in depth beneath cow dung, carrying part of this to the bottom of the hole, and laying its eggs in it. So that when the larva are hatched, they are like those of the Burying Beetle, at once in the midst of food. Now from the fact of the beetle working so much among such a plastic material, we might expect to find it more or less defiled and contaminated with it; but such is not the case, they all seem perfectly new, (if we might use such a phrase), except for the presence of the parasite. We have often asked ourselves where this parasite got its living from, as it seemed almost impossible to extract it from such a fully armoured insect as the Dor Beetle. However, since Dr. Taylor's lecture, in which he told us that the scientific world was only beginning to understand the nature of parasites, and that in the first instance they were only there to clear away what otherwise would be a nuisance, it has struck me that, in the case of this beetle, the presence of the parasite and the absence of dirt, may be cause and effect. We need hardly say that the beetle on first emerging from the pupa has no parasites. An idea of the strength of this beetle may be gained by trying to hold one in the closed hand; do not squeeze it, but give it free use of its limbs, and it will, if so inclined, force its way out from between the fingers. The tenacity of life in the Dor Beetle is something extraordinary. For three days, in a daily walk last spring, we passed one of them in a small water tank apparently drowned; on the fourth day we were surprised to see it making efforts to swim. We took it out and placed it in a cyanide bottle, which generally means death in a minute or two, and let it remain some

four or five hours. We felt quite sure about its being dead now, and so pinned it and placed it in a small collecting box with some others. Two days after we had occasion to open the box and found the beetle walking about over the other insects in its usual blundering fashion, with the pin in it, and destroying a good deal more than what it was worth. A dip into boiling water was resorted to at last, and this is the most certain method of killing large beetles. We have known specimens of Rhagium inquisitor, one of the wood boring beetles, stay for twenty four hours in the laurel box without seeming to suffer any inconvenience from it. Also belonging to this section of beetles is the Scarabæus, the Sacred Beetle of the Egyptians, a rude representation of which may be seen in Mr. R. S. Ferguson's case of Egyptian curiosities.

Of the next section of beetles, the Sternoxia, we shall take one beetle to represent it, that is the well known Skipjack, to be found almost everywhere, but very abundant in particular localities We have seen it on a bright June morning on the lower slopes of High St., Kidsty Pike, &c., literally in hundreds. This is the acrobat among beetles, and to see it jump four or five times its own height in the air when laid on its back is rather amusing. This spring is accompanied by a sound which resembles the word click or crick, and from this peculiarity, in Westmorland it gets the name of Crick Neck. The larva of the Skipjack is one of the wire worms so much dreaded by farmers and gardeners, a specimen of which we have mounted for the microscope.

Two more beetles out of the next section, Malacodermata, or soft skinned beetles, and we have done. The first we shall allude to is the well known glowworm (Lampyris noctiluca); and never shall we forget the pleasure derived from first finding this insect on the banks of the Chalk, a small river a few miles from this city, though at that time we were not aware it was a wingless female beetle. Certainly the male shows a small light, but nothing compared with the female, and it is the female which is popularly called the Glowworm. The male beetle is a perfect insect, much rarer than the female, and seldom captured. This beetle divides the honours, if not taking the first place in poesy, with the Dor

beetle, and the allusions to it from Shakespeare downwards are too numerous for mention here. The light from the Glowworm proceeds from the underside of the last three segments of the body, and in the unmounted specimen shown to you these segments are to be recognised by their lighter colour. The Glowworm seems to have the power of retaining or emitting this light at will, for sometimes on being disturbed the light disappears, and it is only after remaining quiet for a lengthened period that the lamp is again lit. The light of the male is not of the same broad brilliant nature as the female, but proceeds from two tiny spots on each side of the abdomen. Dear old Gilbert White says the lamps are put out about eleven o'clock. We should advise you all who have the chance, to introduce the Glowworm to your gardens, not alone from the fact of its being such an interesting insect, but during its larval condition it lives entirely on snails and slugs—often eating the poor snail out of its shell, which affords no protection to the attacks of the Glowworm larva. From the nature of its food, the larva often gets covered with slime; but nature has provided a remedy for this, in the shape of some seven or eight whisks, which are protruded from the end of the tail at will, and which are used to clear the slime from the body.

We have now come to the last beetle, and unfortunately there is no occasion to leave the fireside to study it. Even the very chair you are sitting upon may contain it; and too often has lament been made over some old favourite piece of furniture which has become worm-eaten and worthless, through the attacks of the Anobium Beetles. This beetle is the author of the sounds which give to it the name of the Death Watch or Death Tick, and the terror in which it was held—and is yet in certain districts—is too well known. The mysterious ticking heard in the silent watches of the night, was said to be a warning that some one was going to die; and the effect of this on an invalid, whose mind was thoroughly endued with the superstition, may be imagined; while it was simply a little beetle giving a love call to its mate. We once had the good fortune to trace the sound to the beetle, generally most difficult to do. We were staying over night

at a small Country Inn on the outskirts of the Lake District, when about dusk, our ears caught the ticking of the death watch. Here was an opportunity not to be lost—we had the old room to ourselves and nothing else to do, for all the literature it contained was a Farmers' Almanac and a Whitehaven News a fortnight old. After procuring candles, we commenced our search, and a most exciting hunt it was—the beetle either possessed the powers of ventriloquism, or there were more than one of them; for the sound seemed to change from one place to another, till we were nearly bewildered. However, we changed our tactics, and instead of rushing up and down after the sound, we sat down to watch one particular place; and after a very patient vigil, we discovered the insect on the inside of the door of an old cupboard, which bore unmistakeable signs of the tunneling of Anobium. The power of this insect to resist poison, may be seen from the fact of the root of Monkshood, which I obtained from one of our members, Mr. Fisher, of Bank Street, having been tunneled in all directions, both by the larva and the perfect insect. There is one poison that is too much for it, and pieces of furniture, etc., may still be saved, even when very bad, by injecting into the holes spirits of wine in which corrosive sublimate has been dissolved. We have tried this on several occasions, and always found it answer.

WORDSWORTH.

By the Rev. PROFESSOR WILLIAM KNIGHT.

(Lecture delivered in May, 1878, at Cockermouth, during the Annual Meeting of the Association.)

So much has been said about the genius and poetic mission of Wordsworth—and said so well—that I daresay some of you, who live in his birthplace, may think that the subject is exhausted. After the critcisims of Coleridge and De Quincey, of Sir Henry Taylor, of Brimley, Clough, Robertson, Lowell, and above all of Mr. Stopford Brooke, and the late and the present Professors of Poetry at Oxford, there seems little need to say more.

And yet, there is no possibility of exhausting Wordsworth, any more than of exhausting Plato. When the time comes for the world to feel that the last word has been said about the great idealist of antiquity, men may perhaps think that Wordsworth also is exhausted. Plato, indeed, moves in a sphere, and speaks in a dialect, that is philosophically more profound; but he never soars into a more ethereal region. He does not interpret Nature or human Life more adequately, nor does the student of his works breathe a more untroubled air, than that in which Wordsworth lived and had his being.

In order to a just appreciation of this poet, two things are necessary. First, we must mark the growth and developement in his own mind of a new attitude towards Nature, and Man in relation to nature, as this is disclosed in his autobiographical poem, *The Prelude*,—by far the greatest work of its kind ever contributed to literature. Secondly, we must ascertain the relation in which he

stood to the poetical literature of England in the immediately preceding age, and what new elements he introduced into it, by his twofold interpretation of nature and man.

. . . . . .

[I omit the earlier paragraphs of this Lecture, which dealt exclusively with the first of these two points—the life and individuality of the poet—since that has been often and ably unfolded: and I pass to the second of the questions raised in the preceding sentence.]

I have now to ask, What was it that Wordsworth did for literature and for the world, as no poet before him had done, and no one need attempt to do again? What, in other words, were the distinctive elements of his genius and his power, constituting him a teacher for all time? It is a large question, and one to which many lectures might be devoted.

It is to him, beyond question, that we mainly owe the nineteenth century renaissance, in the poetical literature of England. The so-called poets of the eighteenth century were simply "men of letters." They had various accomplishments, and great general ability; but their thoughts were expressed in *prose*, or in mere metrical diction, which, in the low ebb tide of creative imagination, passed current as poetry, without being so. Towards the close of the century, however, there was a reaction, and a quickening of mind, which took shape in many different directions. One of its most prominent signs was a rise in the poetical temperature. This may be traced mainly to two great European influences; to the growth of modern German philosophy, and to the social and political forces that culminated in the French Revolution. In Germany Lessing, Goethe, Schiller, and Jean Paul, were all the products of this movement. A new way of looking both at Nature and Society had been inaugurated by Rousseau, and our insular mind—never long unaffected by the great pulse of European thought—caught the contagion, and responded sympathetically in many ways, carrying forward the stream of tendency, to new and original issues. Amongst the poets, in whom we trace the working of the new spirit, themselves influenced from very diverse quarters,

were Cowper, Crabbe, and Burns. All the greater poets, though in part the product of their age, are more conspicuously its formative and inspiring spirits. In them, the intellectual and æsthetic energy of a period finds one of its most characteristic expressions. And in the group of illustrious men, who created the poetical literature of England, towards the close of last century, and during the first quarter of this,—Wordsworth, Coleridge, Scott, Byron, Shelley, Keats, with many others of lesser note,—we find a sudden outcome of energy long repressed: as, in this district of yours, after a tardy spring, one week of genial weather will sometimes liberate the imprisoned life of Nature, and cause it to burst suddenly into leaf and bloom.

Of this brotherhood of poets (which in originality and genius far excelled the earlier constellation of the Elizabethan era) Wordsworth was, beyond all question, the leader. In him, the creative impulse, and the new attitude towards nature and man, assumed features altogether unique; and he may therefore be taken as their most prominent literary representative in England.

Accurately to measure his genius, however, either as to its positive amount or special quality, Wordsworth must be compared both with his predecessors and his contemporaries. Few things are more interesting than to contrast his work in detail with that of those earlier writers from whom the whole new movement was a reaction, and with that of those who were borne forward along with him on the rising tide of the renaissance, bringing out succinctly the precise points of difference. Take only two.

Comparing him with Pope, you find in Wordsworth a frankness and directness, the absence of all roundabout or artificial ways of dealing with and describing things. He spoke and he wrote, because he felt, and as he felt; therefore clearly, freshly, adequately. He did not describe what all men saw, but what the majority failed to see only because their 'inward eye' had not been trained to see it. Their mind had never awakened to perceive, nor their heart to feel, the significance of the simplest things; and so, in reading Wordsworth, many became aware for the first time that they

had faculties
Which they had never used; that thought with them
Was in its infancy.

They felt as if a new sense had been given to them, or a power, higher than sense, had suddenly arisen from obscure and shadowy recesses. As Keats wrote, when he first looked into Chapman's Homer—

Then felt I as some watcher of the skies
When a new planet swims into his ken.

Comparing him again with Byron, you find in Wordsworth a healthful radiance, the supreme note of naturalness. His serenity was due to a clear-eyed freshness of perception, and—what is often denied to him—his objectivity of mind. He is never morbid, or hollow, or cynical; while to those who craved excitement he had nothing to offer. As he wrote in the poem of *Hart-leap Well*:—

The moving accident is not my trade,
To freeze the blood I have no ready arts;
'Tis my delight alone, in summer shade,
To pipe a simple song for thinking hearts.

He could not have wailed out his own sorrows to the world in a misanthropic manner, even supposing him to have felt that 'vanity of vanities' was the last word of the wise, in reference to earthly good. To carry, like Byron, through Europe,

The pageant of a bleeding heart,

was impossible to Wordsworth; both, because his heart never bled like Byron's—

the holy forms
Of young imagination keep it pure;—

and also, because he would have scorned to parade his misery. One element in his greatness was, that with open soul he felt the spirit of the age, which took him out of himself, in the first instance, to Nature. He saw that Nature had a revelation to impart which man ought, in 'a wise passiveness' to receive. This he perceived very early, and may be said to have *absorbed* the idea within a spirit singularly pliant, and open to such influence. It gradually consolidated and matured—the form changing, but the

substantial part of the idea remaining unaltered; and it became the increasing purpose of his life to proclaim it to his contemporaries, carrying it out through a long literary career, against all adverse criticism and the want of popular appreciation, and embodying the result in a series of immortal poetic creations.

It is the easiest thing in the world to criticise Wordsworth as Jeffrey did,—the acute Edinburgh lawyer, blind of one eye, who neither "saw life steadily nor saw it whole" and for whom nature contained no oracle or shrine. It is poor criticism even to say, as others have done, that Wordsworth had no humour, and no dramatic faculty; and that he, therefore, belongs to the secondary rank of genius. Humour is doubtless a great power, and Wordsworth had little or none of it. But though the sunny laughter of the humourist is a source of inexhaustible delight to men who have to face much vanity and vexation of spirit, it is intrinsically a poorer thing to resuscitate our cheerfulness by laughter, than to rouse our flagging energies by insight, and fellowship with nature. It is true that Wordsworth would have had comparatively little appreciation of the intricate culture of our age, an age that is daily growing more involved. His poetry traverses a few great lines of thought and feeling, more profoundly than any other poetry does; but its area is not wide. The complex civilisation of the nineteenth century, with its endless detail, was on the whole distasteful to him; and its best side, its redeeming side, was probably not understood. On the other hand, the cure for the fever and fret of the nineteenth (or of any) century was well known, and profoundly grasped by him. The best antidote to the distractions of life—to the frittering away of strength, and the dissipation of energy in trifles—was understood; and by no writer, ancient or modern, has it been more nobly uttered.

It is, perhaps, useless to revive the criticisms of half a century ago, the long-buried judgments that were passed, by the guides of literary opinion in their time, on the merits of this new poet; except, in so far as they afford one of the most significant instances on record, of the powerlessness of hostile or partisan reviews to extinguish original genius, and the certainty of a reversal of their

verdict by the next generation. The Edinburgh Reviewers did, on the whole, more harm than good, by their smart writing. They retarded for years the appreciation both of Wordsworth and of Coleridge, and prevented many of our fathers from coming under an influence, which would have deepened their lives and broadened their culture, whether it increased their cleverness or not. But as surely as those who lose their temper injure only themselves, all literary curses come home to roost; and the verdict of the scornful, though brilliant, essayist, dealing with a mind he cannot comprehend, is reversed in the next generation, and soon forgotten altogether.

We do not now even laugh at Jeffrey's sentence, "This will never do," with which the Edinburgh Polyphemus began his assault upon *The Excursion;* because criticism has itself taught us that Jeffrey was incapable of appreciating one so new, original, and great. It was his misfortune, as much as his fault. The commonplace mind (and many acute critics have very commonplace minds), however clear sighted within its own domain, cannot take the measure of an intellect like Wordsworth's. And in this connection, it is most interesting to look back for half a century and compare the estimate formed of him by the *Edinburgh* and the *Quarterly* with the appreciation of Coleridge, who, during his undergraduate residence at Cambridge, and before the two men ever met, read the *Descriptive Sketches*, and said of them, "Seldom, if ever, was the emergence of a great and original poetic genius above the literary horizon more evidently announced." It always requires some originality to discover the merits of an original mind; and, after all, the poets are the best critics of each other, as may be seen in Mrs. Browning's *Vision of Poets;* though, to be candid, they are sometimes also the worst, witness the *English Bards and Scotch Reviewers.* You will remember, I dare say, Southey's reply to the Ettrick Shepherd, who had said to him, "I suppose you have heard what a crushing review Jeffrey has given *The Excursion.*" —"*He* crush *The Excursion!* Tell him he might as easily crush Skiddaw."

It must be admitted that there are structural defects in the

framework or ground-plan of each of Wordsworth's larger poems, and also in many of his shorter ones. It may even be natural to wish that a mind like Scott's, for example, had constructed the plot of *The Excursion* for him, in whole or in part,—Sir Walter would have done it with so much more artistic skill. But such literary copartnery is not possible. Supposing all initial difficulties removed, irregularities would be seen in the work, in proportion to the originality of the minds engaging in it. The respective portions would not dovetail into one another. The sutures would not fit. Then, had the plot of *The Excursion* been prepared for Wordsworth by such a master of construction as Scott, he would not have kept to it. His idiosyncrasy would have rebelled against the suggested plan, as something that trammelled the freedom of his own mind; and he could not have woven into the more perfect framework, handed to him by Scott, that wealth of imagination which now lies within the less interesting skeleton of his own story. It is easy to see that all literary work has it blemishes, and that the most perfect, in form and substance alike, must have its *lacunæ*, which are even essential to its limited perfection. But it is not always seen, that excellence in one direction must of necessity, be balanced by defect in another; and hence, that the wish to possess a perfect poem, or a perfect philosophy, or a perfect work of art, is as utopian and absurd as the longing for a perfect human being.

It is extremely easy to point out the infelicities and transitions in Wordsworth's style, its 'inconstancy,' its occasional abrupt descents to an inferior level, its sinking from ideality into matter-of-factness, its frequent prolixity, due to the poet's lingering over details and elevating secondary incidents to a primary place, and hence "an eddying instead of a progression of thought." But what is the use of such nimble-witted criticism *now*? It may be of use to prevent an unaccredited poet from fancying that he has secured a place amongst the immortals, merely because he has succeeded in becoming a clever writer of verses. But when one so great, original, and rare as Wordsworth has once taken his place in that Hierarchy, where so few sit together through all time —and when that place is assured to him by the suffrage of posterity

—what is the use of obtruding our petty critical estimates? Is it said to prevent those who belong to his school, and are pleased to rank as his "disciples," from a too indiscriminate eulogy? Good: an intelligible aim, and a useful end. But, surely the world has a superabundance of critics and very few original minds. We are all born critics, but how many are creators? and is it difficult to put even Shakespeare and Goethe, Plato and Aristotle, on the Procrustes bed of criticism, and stretch them curiously about? Besides, every critic has his critic; and while admiration for excellence unites men, animadversion divides them. All the above-mentioned faults in Wordsworth's style were noticed by Coleridge long ago in his *Biographia Literaria*, where the enumeration of blemishes is followed by one of the finest and most discriminative eulogies to be found in the annals of literature, and in which—with true prophetic insight—he says, "His fame belongs to another age, and can neither be accelerated nor retarded."* This estimate of Wordsworth by his friend Coleridge is so just (and in rigour it has not been surpassed by later criticism) that I cannot do better than quote to you its chief points.

He notes "*First*, an austere purity of language, a perfect appropriateness of the words to the meaning. . . . *Second*, a corresponding weight and sanity of the thoughts and sentiments, won not from books but from the poet's own mediative observation. They are fresh, and have the dew upon them. . . *Third*, the sinewy strength and originality of single lines and paragraphs; the frequent *curiosa felicitas* of his diction. . . . . *Fourth*, the perfect truth of nature in his images and descriptions taken immediately from nature. . . . *Fifth*, a meditative pathos, a union of deep and subtle thought with sensibility; a sympathy with man as man; the sympathy, indeed, of a contemplator, rather than a fellow-sufferer or co-mate, but of a contemplator, from whose view no difference of rank conceals the sameness of the nature; no injuries of wind or weather, of toil or even of ignorance, wholly disguise the human face divine. The superscription and image of the Creator still remain legible to him under the dark lines with

* *Biographia Literaria*, p. 165. Ed. 1847.

which guilt or calamity had concealed or cross-barred it. In this mild and philosophic pattern, Wordsworth appears to me without a compeer. . . . *Last*, and preeminently, I challenge for this poet the gift of Imagination, in the highest and strictest sense of the word. . . . In imaginative power he stands nearest of all modern writers to Shakespeare and Milton; and yet, in a kind, perfectly unborrowed and his own."* With this I conjoin the estimate of another acute critic, the poet Delta. Dr. Moir says, "Never, perhaps, in the whole range of literary history, from Homer downwards, did any individual, throughout the course of a long life, dedicate himself to poetry with a devotion so pure, so perfect, and so uninterrupted, as he did. It was not his amusement, his recreation, his mere pleasure. It was the main, the serious, the solemn business of his being. It was his morning, noon, and evening thought, the object of his out-door rambles, the subject of his in-door reflections; and, as an art, he studied it as severely as ever Canova did sculpture, or Michael Angelo painting."†

This leads me to a fresh point in the estimate of Wordsworth. It was the ambition and aim of his life to construct "a literary work that might live;" and he first wrote his own autobiography in verse. The result was such, that he determined to compose "a *philosophical poem*, containing views of Man, Nature, and Society, to be called *The Recluse*." One part of this only—*The Excursion*—was written. *The Prelude*, he tells us, was meant to have the same relation to *The Recluse* as the "ante-chapel has to the body of a Gothic church;" and he hoped that his minor poems, when properly arranged, would be found "to have such a connection with the main work as might give them claim to be likened to the little cells, oratories or sepulchral recesses, ordinarily included in these edifices."‡

In this ambition, you see the love of artistic symmetry and completion. He was not satisfied with occasional "lyric cries,"

* *Biographia Literaria*, pp. 161-186.

† *The Poetical Literature of the Last Half-Century*, p. 65.

‡ *Poetical Works*, vol. vi, *Preface*, p. 4.

or short swallow-flights of song. He wished to leave behind him a literary whole, gathered up into unity, and with a defined purpose from first to last, stately, with massive proportions, and manifold embellishments.

And in connection with this, note his conviction of the high calling of the Poet, and of his responsibility as an educator of his age. He held that the poet's function was not to descend to the level of other men but to endeavour to raise them up to his own level. As he wrote to Sir George Beaumont, from Goslar, "The poet is a teacher. I wish to be considered as a teacher, or as nothing." The strength of resolution with which he pursued this purpose has probably had few, if any, parallels in literature. Fiercely abused, even ridiculed—not by puny assailants, but by the accredited critics of the day—he went on, with a grand tenacity of purpose, to write fresh poems, of the same character; the creative impulse welling up within him, like the waters of a perennial spring. He felt sublimely sure of the verdict of posterity. And yet, it was not his confidence that the judgment of contemporaries would be reversed that kept him loyal to his vocation; but his conviction of the inherent worth of that vocation, his belief in himself, and in the ends to which his life was devoted. His sense of the dignity of his calling, as a Poet, is the greatest in literature. He expresses it in a noble sonnet to his friend Haydon—

> High is our calling, friend! creative art
> Demands the service of a mind and heart
> Though sensitive, yet in their weakest part
> Heroically fashioned—to infuse
> Faith in the whispers of the lonely muse,
> While the whole world seems adverse to desert, etc.

Mr. Lowell thinks that his early conviction of being "a dedicated spirit" led to "a one-sided, as well as to an intense development of his intellectual powers; and that this was fostered by the solitude of his life, which deprived him of any standard of proportion outside himself, by which to test the comparative value of his thoughts." Let us grant it. But had he possessed such 'a standard' the world would probably have been deprived of

much that he has given it. A 'standard of proportion' would have repressed the outflow of his genius, dwarfed his originality, and checked the free course of that stream of imaginative ardour to which we owe so many immortal creations, and so much of the scattered wealth of his poetry. We may be thankful that the greater poets have seldom had a perfect "standard of proportion." The rounded completeness which comes of culture would have *maimed* Wordsworth altogether.

It is refreshing to turn from the critics, and listen to the poet's own estimate of his office, and of its fulfilment in the future. He said to his nephew:—"Every poet must diffuse health and light; he must prophesy to his generation; he must teach the present age by counselling with the future; he must plead for posterity."* To his friend, Lady Beaumont, he writes as follows of the *Lyrical Ballads*. The quotation is a little long, but it is so excellent that I must give it in full. "It is impossible that any expectations can be lower than mine concerning the immediate effect of this little work upon what is called the public. I do not here take into consideration the envy and malevolence, and all the bad passions which always stand in the way of a work of any merit from a living poet; but merely think of the pure, absolute, honest ignorance in which all worldlings of whatever rank and situation must be enveloped, with respect to the thoughts, feelings, and images on which the life of my poem depends. The things which I have taken, whether from within or from without, what have they to do with routs, dinners, morning calls, hurry from door to door, from street to street, or foot or in carriage, with Mr. Pitt or Mr. Fox, Mr. Paul or Sir Francis Burdett, the Westminster election or the borough of Honiton. . . There neither is, nor can be any genuine enjoyment of poetry among nineteen out of every twenty of those persons who live, or wish to live, in the broad light of the world, amongst those who are striving to make themselves people of consideration in society. Trouble not yourself upon the present reception of my poems; of what moment is that compared with what I trust is their destiny? To console the afflicted; to

* *Memoir*, vol. ii. p. 7.

add sunshine to daylight by making the happy happier; to teach the young and the gracious of every age to see, to think, and feel, and therefore to become more actively and securely virtuous; this is their office, which, I trust, they will faithfully perform, long after we (that is, all that is mortal of us) are mouldered in our graves. . . . Never forget what was observed by Coleridge, that every great and original writer, in proportion as he is great or original, must himself create the taste by which he is to be relished, he must teach the art by which he is to be known. . . . . My ears are stone-deaf to their idle buzz, and my flesh as insensible as iron to their petty stings. I doubt not that you will share with me an invincible confidence that my writings (and among them these little poems) will co-operate with the benign tendencies in human nature and society wherever found; and that they will, in their degrees, be efficacious in making men wiser, better, and happier."

Again, in the same strain, to Sir George Beaumont he writes: "Let the poet first consult his own heart, as I have done, and leave the rest to posterity—to, I hope, an approving posterity."

No one can fail to be struck with the nobleness, I might almost say the sublimity, of these thoughts. The grandeur of dedicating life to *work* has been taught us by Carlyle in a very significant manner; but to consecrate it to thought and communion with Nature; to prolonged, devoted, wistful fellowship with her, in her ever-changeful moods, while at the time faithful to the moral ideal; this is a still grander aim, and a yet nobler achievement.

I shall not say much about Wordsworth's special theory of poetry. He believed that it takes its origin in "emotion recollected in tranquillity." The poet, he held, should represent the incidents or scenes of real life, in which the emotions are at their natural height, or in their intensest outflow. To this, few discriminating minds can take exception. But then, he went on to say, that since at these times men naturally use a language precisely adapted to the situation, the poet ought to use the same language, modifying it only to this extent, that he must omit the disagreeable, remembering that his function is to give pleasure. Further, the

metrical form into which he casts his language delights the reader or hearer, by 'the succession of pleasurable surprises' which it gives, and rhyme adds an additional delight.

Now, it is doubtless true that, if we remove all the crude phrases used by men in a state of vivid emotion, the natural language they then employ is sometimes the choicest. But, this 'natural language' before it is fitted for the purposes of poetic expression, must pass through a further process of refining, in the alembic of the poet's own soul. The language of real life, if it be natural, spontaneous, and unconscious, very often assumes a poetic form; but the conversational style of speech, however simple and natural, could never become the sole, or the highest style for literary or artistic expression. The most animated and brilliant conversational style does not make the best literary style; and the choicest language of real life must come forth from the poetic mint —not in the hard, realistic shape in which it entered in, nor, on the other hand, artificialised by its presence there—but *recast* in a form of ideal grace, the 'naturalness' of its original form preserved, and a new adequacy imparted to it. This much may fairly be said in in criticism of Wordsworth's theory, as to the language of which the poet should make use.

In the preface to the first edition of the *Lyrical Ballads* he says that his aim was "to ascertain how far the language and conversation of men in the middle and lower classes of society is adapted to the purposes of poetic pleasure;" and, in the second edition, he describes it as "an experiment." His own practice was better than his theory, and in part disproved it. No doubt, he frequently carried out the latter consistently, to the verge of a bald literalism; and it was easy for the critics to hold up to ridicule the "tub" of the blind boy, and the "swollen ancles" of Simon Lee. But on the other hand, had Wordsworth *not* carried the realistic tendency at times too far, it may be doubted if the literary world, in his own and the next generation, would have learned to appraise it truly. It is to be farther observed, that what his theory sanctions, and tends to, is the use, not of the language of common life, but that of simple, natural, unaffected life.

Much more important than the form, however, is the subject-matter of all poetry. It has been affirmed that its essence consists in its form alone,—the form given to thought by language. This is one of the delusions against which Wordsworth's whole vocation and achievements are a protest. You hear it sometimes said vaguely, that the movement which in England began with Cowper, which Burns carried out so fully in one direction, and which Wordsworth developed to such magnificent results, was a return to *nature*, to the simplicity and truth of nature, from the artificiality and mannerism of the past. This is undoubtedly true; but it is too indefinite a statement to be of much value. The precise significance of the 'return to nature' must be ascertained. Now, you will not only find a clear natural note struck by Wordsworth, in the simple way in which he described what he saw, and was not ashamed to speak of it *as* he saw it—calling the sun, the sun, and not 'bright Phœbus,' as the eighteenth century men would have done. But, in addition to this, in selecting the subjects on which to write, he found that his predecessors had departed so far from nature, into artificial regions, and dealt so largely with conventional topics, that he had, in the first instance, to go back, in the homeliest fashion, to the most obvious facts of every-day experience. The idea of writing a poem about sheep, or daisies, seemed to the magnificent men of the Pope and Johnson era to indicate some incipient lunacy. They thought that the man was moonstruck who could write serious verses about 'daffodils,' or 'pedlars,' or 'boats,' or 'waggoners." Now one element in the greatness of Wordsworth was that, by "the power of a peculiar eye," he saw a meaning in the lowliest things of earth, and in the apparently forlorn specimens of humanity, which few other eyes in his time perceived. He did not roam over the broad earth, seeking materials for romantic narrative, and thrilling story. He asked, What is to be found at hand, if we open our eyes to see it? what meaning in nature? what significance in life? Can we not get beneath the surface of both? and apprehend, in a real and verifiable manner the truth of that which is unfolding itself around us every day, instead of floating down the stream, chasing the shadows of excitement, or

vaguely sighing for changes? Though intensely fond of travelling, he never could have said or felt, with Goethe,

> To make room for wandering was it
> That the world was made so wide.

On the contrary, within the circle of his own mountains, and among the simple unconventional dalesmen of the north he sought for a deeper meaning, underlying the commonplaces of life and nature. To Wordsworth, the 'open secret' lay at the heart of the most familiar, lowly, and even common things. The humblest object in nature, if approached with reverence, the most trivial task in life, if discharged with dignity, was at once transfigured, and lit up with ideal grace in the light of that transfiguration.

But how are we to see this latent significance in common things, this worth within the trivial and the familiar? The difficulty is a most real and serious one to many. Wordsworth's answer is substantially this—It is by the opening of the inward eye. There is no veil on the face of Nature, needing to be removed: the film is on the human eye. We do not see what is everywhere around us to be seen, because our organ of vision is impaired; and the malady is, to a great extent, hereditary. But the recovery of the power of sight—that second sight, which divines the secrets inaccessible to the material organ—is effected by simple contact with Nature herself; not by the secondary study of her through books, through literature, or through science, but by familiarity with her face to face, in the ever-fresh and renovating processes incessantly at work around us.

If we are to reach the secret of Wordsworth, however, and find his "healing power," we must apprehend something more about it, even than this. There are one or two preliminary things to be noticed. Those of you who have made his acquaintance at all, will not have failed to note the accuracy of his local allusions, the rigid fidelity of his descriptions. They are not photographs: but they are far better. They are *divinations* of the spirit of the places he describes. His topographical allusions are so numerous and minute that some have felt them to be wearisome; but there

is no spot in all your district, to which he has referred, which he has not *interpreted*, illumining it with

The light that never was on sea or land.

It is this element of local colour, in his poems, that has made the whole region of the English Lakes pre-eminently classic ground. There is no place in Scotland associated with the genius of Burns or of Scott—Ayrshire, Tweedside, Loch Katrine, or the Western Isles—over which the ethereal light of imagination still broods, as it lingers amongst the hills and dales of Cumberland and Westmoreland. And if the remark of Mr. Lowell, that the poet was "the historian of Wordsworthshire," has any force, it is part of his imperishable renown that he *created such a shire*, and gave it a meaning vastly more interesting than those geographical county boundaries, to which the poet's work as stamp-collector was confined.

Wordsworth possessed, first of all, a wide knowledge of nature; a knowledge that was broad, intimate, minute, and thorough. Hence the perfect truth of his description of the external aspects of a scene, before he sought its inner meaning, or its "soul." Without such accuracy of perception and report, no divination was possible. He was unerring in the fidelity with which he observed the minute features of nature, which other eyes failed to see. One day some one told him he had heard that he (Wordsworth) had written a poem upon a daisy. "No," said the poet indignantly, "it was on *the* daisy, a very different thing!" He had unusually fine physical senses; and, with rapid intuition, he pierced beyond the reports they brought him, of form, colour, sound, etc., that he might discern the underlying suggestions, with which the scene was charged. His special greatness, as an interpreter of Nature, lay in his power of divining the *genius loci*,—that subtle arrowy glance going direct to the very core, always adequate, and usually profound, often tenderly human; in every instance bringing back some secret, and disclosing the immeasurable significance of common things. He was never contented with deciphering outward features. Forms, colours, sounds, always led up to some

Remoter charm
Unborrowed from the eye

or ear. Nature's face was full of *expression;* and this expression revealed *character*, as truly as a human face reveals the workings of emotion in a human soul. Other poets were content simply to chronicle natural phenomena, as beautiful, or grand, picturesque, or sublime. Wordsworth always asked, What is the meaning of Nature, in those places where she has concentrated her expressiveness, and in those moods in which she seems to be unburdening herself to man? What is the secret of the glory of the sky, at sunrise or sunset? and their difference? What is the meaning of the motions and balancings of the clouds? of the alternate wail and sigh of either wind or ocean? Or, if he did not *ask* these questions, he answered them without asking. All that is distinctive in his poetry, grows out of the belief that Nature's soul has a definite expression, whether in rock or flower, in tree or stream, and can be recognized. It can appeal to us, and mould us. In each natural object, some 'invisible thing' is 'clearly seen.' Wordsworth, in short, had a strong, intuitive grasp of that subtle spirit of the Beautiful, which breathes throughout the whole framework of nature, emanating from, and expressing itself in, the life of every material thing.

But it is important to go, if possible, a little deeper down, and see to what this distinctive feature amounted; because we hear it constantly reiterated—and with vague inaccuracy affirmed—that Wordsworth was *a subjective poet*, that he thrust himself into the scene he described, and saw his own individuality (nay his own idiosyncrasies) mirrored in Nature. Nothing could be more erroneous; nothing less exact. It is both an utterly irrelevant, and a totally ignorant criticism. It is irrelevant, because I suppose it is not possible for a poet, any more than for a critic, to escape from his own shadow. It is ignorant, because Wordsworth's subjectivity is not greater than, it is not nearly as great as, that of his contemporaries,—Scott only excepted. Byron's heroes, for example, are more Byronic, than Wordsworth's are Wordsworthian. It is one of the most foolish and futile of charges, either that he was imprisoned within the circle of his own subjective broodings about

Nature, or that his characters were the mere duplicates of himself. Not only was "the mind of man," (as he says)

The haunt and the main region of my song;

but Nature was nothing to him apart from man. Still further, it was man as social, man in relation to his fellows, man organized in society, that chiefly interested him.

The charge of throwing his own subjectivity into Nature, and "seeing himself in all he saw," is so foolish that it is difficult to deal with it. He saw a life in Nature distinct from his own, yet kindred to it, a reciprocal and complementary life. You may say, if you choose, that *Imagination* enabled him to do this; and that, without imagination, he could not have been brought into such a living *rapport* with Nature, as certainly, without it, he never could have chronicled the things he saw. But imagination gives insight, as well as creative power; and insight must in all cases go before creation, if the latter is worth anything. Poetic creation is simply the embodiment in an imaginative form, or in an intellectual and æsthetic shape what has previously been discerned or divined. Now Wordsworth's very speciality as a poet lay in this, that he interpreted the universe in terms of humanity, *without* throwing over it the mantle of his own subjectivity. He read its secret, by the use of his own faculties of course, and with the aid of the 'auxiliar light' which 'came from his mind,' but not by a process of mere idealisation. He saw Nature through his own lens—less he could not do without ceasing to be a poet, or even a man. But he did more than this. He saw into Nature's innermost heart, and was throughout and pre-eminently, a seer, and not an idealiser. He perceived that the universe is animated by a living and recognisable soul; that we do not err in describing it as, at least, quasi-human: and conversely, he not only desired to bring humanity into vital contact with the sunshine of the broad world, and to

Feed it, 'mid nature's old felicities;

but he saw that human life finds its deepest interpretation, in direct relation to nature. Thus Nature reveals man, while Man mirrors nature.

Not only so: not only was Nature, according to Wordsworth,

instinct with personality (or what resembled it), but the spirit or soul of nature, animating and informing it everywhere, was recognisable and realisable in detail. It was not always, nor indeed usually recognisable, as one vast all-comprehending Force: but to our vision, was divided into many single forms and phases. Each separate object, every flower, every mountain, every star, had its spiritual essence or informing soul, which was vitally related to the larger soul of the world, the poet could not tell how. It was for the speculative philosopher to say,—if he could,—what were the relations between the separate objects, and the universe as a whole. The poet might occasionally refer to the underlying unity, which he realised as vividly as the philosopher, or more so. But his special function was to interpret the detail, or the specialisation of nature; its variety, rather than its unity.

Thus, the soul of nature, localised here and there,—just as humanity is individualised in separate men and women—has, to the poet, its own peculiar life and changing moods. Not only has each mountain or stream its *genius loci;* but that genius is fully as changeful as man—now bright and radiant, again depressed and dull. It is alternately glad and festive, mourning and bereaved. Nature is seen toiling, rejoicing, sorrowing, just as we toil, rejoice, and sorrow. And this is not the polytheistic notion of separate beings, as tutelary gods, oreads, dryads, etc., inhabiting distinct localities. These were detached from nature, spirits that came and went, and were as capricious in their comings and goings, as fairies are alleged to be. But there is a wide interval between a belief in ghosts and fairies, and a recognition of those 'souls of lonely places,' or the 'spirit of the woods', mountains and floods, of which Wordsworth speaks. In the latter case, the inner spirit of the Universe is recognised, revealing itself to us, in this way, as the breathing life of the place,—a portion of the infinite Existence, not really cut off from the rest, but only seeming to be so, to our finite imagination. The link connecting part with part may be too subtle for us to trace, but it exists, and is felt to exist, at the very moment when our perception of difference in the parts is keenest.

Thus 'the mighty being' of Nature, ever 'awake,'* manifests itself

* *Miscellaneous Sonnets*, part i. Sonnet 30 (vol. ii. p. 275).

incessantly and simultaneously, in a hundred different ways, all over the world; its diversity not destroying its unity, nor its unity abolishing its diversity. It is too vast for human realisation as a whole. In virtue, however, of its apparent divisions, its dismemberment to the human eye—assuming, as it does, an immense variety of phases—it can be realised in detail; and, in fellowship with any one of the details, the soul of man has unquestionable fellowship with the very essence of nature. Each of these, when apprehended by us, awakens a kindred or correspondent state of feeling, while the conviction of the profound unity of the whole remains unshaken. The highest life of each separate object having thus an interior relation to the life of every other, there is reciprocity amongst them all, a never-ceasing intercommunion, as the common element ebbs and flows throughout them. This is admirably expressed by Mr. Stopford Brooke. He says:—

"This idea is the loveliest of all which Wordsworth has introduced into English poetry, and it flowed from his conception of everything in nature having its own peculiar life. . . . There was ceaseless intercommunion founded on the unutterable love which flowed through all things, and with which every thing acted on every other. The whole world was linked together; every part, every element, gave and received, honoured and did service, to each other. . . . And they delight in social intercourse, like friends who love each other—there is no jar, no jealousy, no envy there—their best joy is in being kind to one another."*

And better illustrations of this idea than those which Mr. Brooke has selected from the poems could not be chosen:—

Through all her depth, St. Mary's lake
  Is visibly delighted,
For not a feature of the hills
  Is in that mirror slighted.

Or again—

There is a blessing in the air,
  Which seems a source of joy to yield
To the bare trees, and mountains bare,
  And grass in the green field.

. . . . . .

* *Theology in the English Poets*, p. 107.

Love, now an universal birth,
From heart to heart is stealing,
From earth to man, from man to earth,
It is the hour of feeling.

It must be observed, however, that the perception of this feature of the life of Nature—its semi-human characteristic—and the intercommunion and reciprocity to which it gives rise, is not possible at all times. It is only perceived when certain subjective states of the percipient mind correspond with special objective conditions in Nature itself. When these conditions are realised, material forms seem but the raiment of a life beneath them, which alone is real. As this life is not discerned by us equally in every object, but only in some, so it is not apprehended every moment, but only occasionally. If an apocalypse were constant, it would be like the sunrise, and cease to be an apocalypse; just as a constant discernment of the underlying unity of things would prevent us from recognising the diversity which plays npon the surface. But when our faculties are at their keenest stretch, and when our external conditions and surroundings are favourable—as, when on the high hill tops, or under the clear vault of the sky on a still and luminous night, or by the shore of the everlasting sea—the veil is at its thinnest; and the conviction is flashed upon us, that the life of Nature is fundamentally kindred to our own. The persuasion that Nature desires our fellowship is then no fancy, but an intuition of the heart and the intellect and the æsthetic sense combined. For example, if you gaze into the heart of some tenderly beautiful flower as it looks up from the moorland to the sky, or listen to the sound of running waters on a far-off mountain side, or watch the radiance of the clouds that gather round the setting sun, does the sense of *solitude* deepen, or does the feeling of a latent bond, and hidden social unity survive? Is the prevailing thought that of the coldness, and silence, and unrecognisableness of nature, or of its kindredness, its affinity, and its friendship? Whatever it may be with the *laws* of nature,—whether they do or do not correspond, as Mr. Hinton put it, to the habits of a friend, —the *life* of nature (of which the laws are the expression) is a continual revelation of *character;* unfolding itself, now more clearly,

and again more dimly, as the clouds break or gather upon its face, and as the eye of the beholder is fresher or duller in its perceptions.

I need scarcely guard myself against mistake, by adding that it is easy to carry this notion of kindredness *too far*, and thus to degrade it altogether. If we do not recognise the transcendant unlikeness of nature to man, along with the likeness which exists, the latter idea is more than vulgarised. It becomes distorted and untrue. Only through the recognition of the former notion does the latter gain its reality and grandeur. We do not need, however, to be reminded of the difference, so much as of the resemblance. The former idea always takes care of itself. It is constantly suggested, and sometimes painfully obtrusive: the latter is occasionally grasped, is often dimly possessed, and is always fugitive. Too soon the curtain falls, the glory fades; and after every disclosure of Nature's heart, in the most lovely of its apparitions, we are again in the presence of the old grey skies, the silent and the seemingly unresponsive heaven. But the two feelings, whether major or minor, whether for the time in the foreground or the background of consciousness, are complementary ones. They are, indeed, but the two sides of the knowableness and the unknowableness of the Infinite.

Our inability to look on nature as Wordsworth did, is as often due to our artificiality, as to our shallowness. If nature is to continue to subdue, to teach and to mould, as well as to fascinate us, we must retain the heart of childhood, with its natural wonder, delight, admiration, and reverence,—let the intellect develop as it may. In a 'wise passiveness' we must receive her sweet influences from without. She won't yield up her secret to us when we are being whirled along on the surface of life's stream, absorbed, and excited by artificial things, or magnetised by any secondary interest. This was nobly taught by Wordsworth in the sonnet beginning—

> The world is too much with us. Late and soon,
> Getting and spending, we lay waste our powers.
> *Little we see in nature that is ours.*

There is a most intimate relation between Wordsworth's

moral elevation and his intellectual insight. The artificiality and mannerism, the haste and distraction, of our modern life, with its many prolix ceremonies, prevents the simple *rapport* of the mind with Nature, in which all natural poetry is born. Furthermore, the marriage of the soul with nature is a union of equals; and its result is a realisation of that other or higher self, our *alter ego* in nature, not (as I have already said) as an idealisation of the mind, but as a reality of mental vision. Transcending all subjective bonds, we enter a region 'where time and space are not,'—a world of higher apperception, in which the unity of self and not-self, of the mind within and the universe without, is clearly understood,—while neither the one nor the other is overborne, but their fundamental separateness preserved.

Too much stress cannot be laid upon another feature kindred to this, in the teaching of Wordsworth. It is Nature's office to cure us of morbidity and melancholy, as well as of artificiality; its healing and restoring function calming us, reanimating and reassuring us. He shows, as few teachers have shown, that while full of sympathy with us, Nature will not abide our sadnesses. She feels them to be an intrusion on her peace, her immense latent life, out of which all that allays them proceeds. Our introspectiveness and self-consciousness are rebuked by Nature, whenever we are alone with her, and open to her influences: and it is as necessary that these should be taken out of us, as the conceit that we have fathomed her ways and processes of work. She reveals an impersonal Order as well as a personal power, a transcendant and utterly mysterious life, with which we may not presume to be too familiar; and it is merely this side that is turned towards us,—the seemingly stony and unresponsive side,—when we complain of her mysteriousness. But who will say, that, in this, she does not educate us also?

In the same connection, I claim for Wordsworth a clear knowledge of the profoundest problems, with which the human mind has grappled, from Heraclitus to Immanuel Kant.* He

* It is for this reason that a knowledge of Wordsworth is one of the very best introductions to the Platonic (or any other) Philosophy. There are

seems to have penetrated to the very core of philosophical ideas, not by laboured argumentation, but by intuitive discernment—both intellectual and moral—which began early and developed rapidly, keeping pace with the growth of his imagination. By that consummate vision, which is superior to all processes of reasoning, he reached the ultimate data of speculative Philosophy and Theology.

Further, in dealing with the perennial problems, Wordsworth almost always keeps to their elements. He therefore moves within a verifiable region; and hence his treatment of the questions cannot be superseded. His poetry is intrinsically durable; not only because—like all poetry of the first magnitude—it is a joy to the human race for ever; but also because it has no mythological elements, which Science may some day compel us to lay aside. He carries us into a region altogether unaffected by the discoveries, which imperil a merely traditional faith. Let Science march forward as it may, and where it may, Wordsworth's poetry moves in a sphere unaffected by its conclusions, a sphere indeed to which its widest generalisations bear witness, and pay tribute.

And this leads me to speak of the bracing effect, the moral tonic, to be found in his poetry. It presents a high ideal of life, elevated alike above the sordid and the capricious, above the trivial, the artificial and the ignoble. Hence there is no *ennui*, no *tedium vitæ*, in Wordsworth. Every one knows his reference in the sonnet to 'plain living and high thinking:' but few have adequately realised the immense serenity, the large divine tranquillity, and the indefinite hopefulness, that breathe through all his writings. In him, aspiration blends with contentment; placidity and calm, with effort to be other than we are, and with a belief in the endless possibilities of human nature. This is the secret of what Mr. Arnold has so happily called his 'healing power.' You feel it, just as you feel the effect of mountain air after languishing in a city. The 'strength of the hills' is in almost everything he wrote. And

numerous passages in *The Prelude* and *The Excursion*, as well as in the minor poems, which condense within them the essence of the great ideal systems of Plato, Spinosa, and Kant. Many a single line of Wordsworth's contains a precise and singularly felicitous embodiment of the philosophical ideas which lie at the heart of these systems.

there is no influence so good and gracious as Wordsworth's, so directly *sanative*, to those who have felt a relaxation of fibre, from long pondering on the 'riddle of the painful earth,' or brooding over the antinomies of our intellectual and moral nature. There is a well-known sense of hopelessness, when one is beaten down before the mysteries of the universe, if these have been wrestled with and found insoluble, and a feeling of languor and indifference—the *cui bono* feeling—is incipient. To one, in such a mood of apathy or life-weariness, the influence of Wordsworth is incomparable. His poetry is a moral tonic, reinvigorating the heart, by taking it straight away to some fresh natural well of feeling, or of thought. Great as he is, therefore, as a poet, I consider him still greater as a moralist. His sense of the infinite moral unity of which we are but parts, and his conviction of a

> Central peace, subsisting at the heart
> Of endless agitation,

are as guide-posts in ethics. In the forest paths of human life, with their labyrinthine windings, or, when out in the open, cross-ways meet and perplexity is inevitable, he, of all poets, best helps you to know where you are, what direction to take, and how to travel forward with serenity, and even with joy. If his teaching—as embodied, for example, in the *Ode to Duty*, or in the chapter of *The Excursion* entitled "Despondency Corrected,"—is inconsistent with a Goethean sweep and universality, delighting in all things with frank objectivity, simply *because they are*, its narrowness is the narrowness of one who has a root in himself, of one who has found

> Within himself a measure and a rule.

And one, thus taught and disciplined, will 'live and breathe,' as he says—

> For noble purposes of mind; his heart
> Beats to the heroic song of ancient days;
> His eye distinguishes, his heart creates.

In all that I have said, I have been giving you the merest introduction to the poetry and poetic mission of Wordsworth. Those of you who have not yet begun the earnest study of this poet—and he requires not only to be read but to be studied—may

consult, along with the poems themselves, two discussions, which, amongst the large literature that has now accumulated on the subject, are, in my judgment, by far the most thorough and satisfactory :—I refer to Principal Shairp's *Essay on Wordsworth*, originally contributed to the *North British Review*, and republished in his *Studies in Poetry and Philosophy*; and Mr. Stopford Brooke's volume, entitled *Theology in the English Poets*. The former is more condensed and finished as a work of art; the latter is more detailed in its analysis, and almost exhaustive in one direction.

Before closing, I merely add, as I have already hinted more than once, that there is no poet after Shakspeare more worthy of prolonged, careful, and even reverential study, and especially of study by women. There is none whose influence on character is more ennobling, and from contact with whose spirit you can draw a serener inspiration. And though our poetical literature is now becoming more complex, and many a kindred spirit has embodied fresh forms of Imagination in the raiment of our English speech, since Wordsworth breathed his last at Rydal Mount, he remains one of those

> Stars pre-eminent in magnitude
> Which, from the zenith, dart their beams,

of which he spoke; and he has deeper things to teach us, in our nineteenth century haste and high pressure, than any of his comates, who are seated along with him on the imperial height.

It may be as difficulty for some to get within his circle, as it is for others to understand Beethoven, or Fra Angelico. Nevertheless, his is an 'open secret,' and as he said of Burns,

> In busiest street, and lonliest glen,
> Are felt the flashes of his pen.
> He rules 'mid winter snows, and where
> Bees fill their hives.
> Deep in the genial heart of men
> His power survives.

And sure I am that long as the streams of Westmoreland sing their songs of 'peace with quiet blending,' long as Helvellyn rears its head above the neighbouring hills, and the sunlight and the moonlight come and go amongst the mountains, the radiance of this

Poet's genius will shed a more ethereal light over the whole district, and will disclose the inmost soul of Nature, and the boundless significance of Life to the English generations of the future.

He found us when the age had bound
Our souls in its benumbing round;
He spoke, and loosed our hearts in tears.
He laid us as we lay at birth
On the cool flowery lap of earth,
Smiles broke from us, and we had ease;
The hills were round us, and the breeze
Went o'er the sunlit fields again;
Our foreheads felt the wind and rain.
Our youth returned; for there was shed,
On spirits that had long been dead,
Spirits dried up and closely furl'd,
The freshness of the early world.

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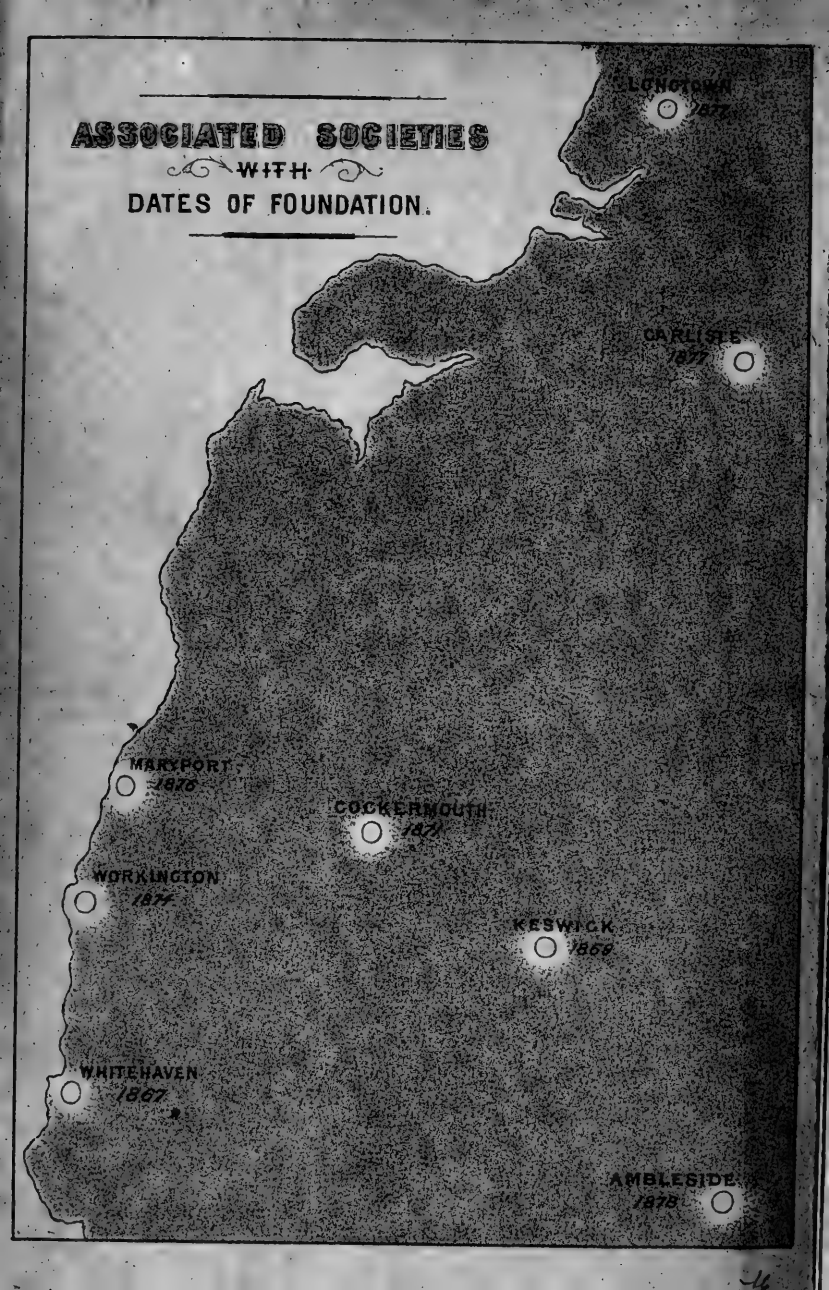
ASSOCIATED SOCIETIES
WITH
DATES OF FOUNDATION.
CLONCTOWN
1877
CARLISLE
1877
MARYPORT
1876
COCKERMOUTH
1871
WORKINGTON
1874
KESWICK
1869
WHITEHAVEN
1867
AMBLESIDE
1875